



CPS2015-0260

ATTACHMENT 1



# THE CITY OF CALGARY

## BIODIVERSITY REPORT | 2014



CONSERVING BIODIVERSITY GLOBALLY, THROUGH LOCAL GOVERNMENT

CPS2015-0260 Biodiversity Strategic Plan - Att 1.pdf  
ISC: UNRESTRICTED



The aim of the Local Action for Biodiversity (LAB) Programme is to assist local authorities in implementing the three objectives of the Convention on Biological Diversity (CBD). These are: 1) The conservation of biological diversity; 2) The sustainable use of the components of biological diversity; 3) The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

LAB is a global partnership between ICLEI – Local Governments for Sustainability and IUCN (the International Union for Conservation of Nature). ICLEI is an international association of local governments and national and regional local government organisations that have made a commitment to sustainable development. ICLEI is the largest international association of local governments as determined by budget, personnel or scale of operations with well over 1,000 cities, towns, counties, and their associations worldwide comprise a growing membership. IUCN is the world's oldest and largest global environmental network – a democratic membership union with more than 1,000 government and NGO member organizations, and almost 11,000 volunteer scientists in more than 160 countries.

LAB assists and interacts with local authorities in a variety of ways. Technical support is provided in the form of ongoing communication as well as guidelines and review of relevant documentation, presentations etc. and through access to IUCN's extensive network of scientists. As participants in LAB, local authorities are provided various networking opportunities to share their challenges and successes. Profiling is also achieved at various international forums where the efforts of participating local authorities are exhibited and reported on. Increasingly, LAB is playing a critical role in global advocacy, providing a platform for local authorities to voice their input and to demonstrate the importance of their role in stemming the tide of global biodiversity loss.

For more information about Local Action for Biodiversity contact [lab@iclei.org](mailto:lab@iclei.org) or log onto the LAB website at [www.iclei.org/lab](http://www.iclei.org/lab).

# FOREWORD



Calgary started at the confluence of the Elbow and Bow Rivers. Community leadership in our early history largely kept these vital ecological corridors intact. These rivers are as important to Calgarians as they are to wildlife, and, in part, they represent Calgary's heritage: our connection to landscape and our connection to nature. The foresight of our predecessors helps define what makes Calgary such a great place to live. And these types of commitments continue. For example, our wetland conservation policies conserve the internationally significant wetlands that characterize Calgary.

By recognizing our interconnectedness, both with each other and with the natural world, I am very pleased to partner with Local Action for Biodiversity and make The City of Calgary a signatory (through City Council direction) to the Durban Commitment for Biodiversity. This represents our commitment to protecting our natural heritage and innumerable benefits that it provides to us.

And we have much to be proud of.

At 1129 hectares, Nose Hill Park is one of the largest municipal parks in North America. The protection of this region of natural grassland was led by Calgarians, with 10 community associations working together to recognize this invaluable natural asset.

Ralph Klein Park is another wonderful example of our City's commitment to dialogue and collaboration. Established within a 200-hectare constructed stormwater treatment wetland complex, this park is 30 hectares of open space devoted to environmental education and awareness. In addition to interpretive trails and public art, the park's Environmental Education and Ethics Centre is dedicated and built upon sustainable building best practices and represents the inventive nature of Calgarians.

The Rotary/Mattamy Greenway project by Parks Foundation Calgary also represents our commitment to working with citizens, communities, corporate donors, and non-profit organizations to create important natural spaces for all Calgarians. Once complete, the Greenway will be a 138 kilometre route that will encircle the city and be the longest urban pathway in the world.

This 2014 Biodiversity Report is the next step in continuing Calgary's land stewardship. Knowing where we are now in terms of our urban conservation, what we have, and how we govern it acts as the foundation for our future commitments to conserve biodiversity in Calgary.

Biodiversity connects us. It's not just about protecting the environment. It's about protecting our health, our economy, and our culture. Although the growth of Calgary presents significant challenges, it also offers exciting opportunities. I am proud to be the mayor of a city that continues to make advances in our environmental awareness and actions.

Sincerely,

Naheed K. Nenshi  
MAYOR

# ACKNOWLEDGEMENTS

The City of Calgary Parks would like to thank the following organizations for their efforts in producing the Biodiversity Report. They were invited to review and comment. Their ongoing support is appreciated.

## ORGANIZATIONS

Alberta Native Plant Council  
Alberta Wilderness Association  
Bow River Basin Council  
Bowmont Natural Environment Park Committee  
Calgary Field Naturalists (Nature Calgary)  
Calgary River Valleys  
Canadian Parks and Wilderness Society  
Ducks Unlimited Canada  
Edworthy Park Heritage Society  
Elbow River Watershed Partnership  
Friends of Fish Creek Provincial Park Society  
Friends of Nose Hill Society  
Nose Creek Watershed Partnership  
Weaselhead/Glenmore Park Preservation Society



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# PREFACE

This document forms part of a set of biodiversity reports produced by participant cities of the ICLEI Local Action for Biodiversity (LAB) Project. It represents a critical starting point: a status quo assessment of biodiversity and its management in each LAB city.

Each biodiversity report covers four key themes,\* namely:

- Ecology
- Governance
- Integration
- Participation

Each biodiversity report will be drawn upon to contribute significant and useful information for the compilation, by the LAB Project Team, of a Biodiversity Toolkit document. This document will contain best practice theory and examples, principles, strategies, etc. for use by cities to better manage and integrate biodiversity into planning. The Toolkit will in turn contribute towards further steps in the LAB process.

The five steps in the LAB process are as follows:

**Step 1:** Development of a biodiversity report that documents the current state of biodiversity and its management within each city.

**Step 2:** Ensuring long-term commitment by city leadership to sustainable biodiversity management through LAB cities formally signing a local government biodiversity declaration.

**Step 3:** Development of a 10-year biodiversity action plan and framework that will include commitments to biodiversity implementation plans and integration within broader city plans.

**Step 4:** LAB cities' formal acceptance of their 10-year biodiversity action plans and frameworks.

**Step 5:** Implementation of three new on-the-ground biodiversity interventions by the end of the three-year project.

These reports create a unique opportunity for profiling the importance of urban biodiversity, and innovation in its management, on a global scale. They are the foundation not only of the long-term plans that each city will develop to enhance, protect and develop their urban biodiversity, but also collectively form the basis for the development of LAB as a highly effective global urban biodiversity initiative.

LAB Project Team

May 2007

Cape Town

*\*Some cities' Biodiversity Reports do not follow this specific order or these specific headings.*

# EXECUTIVE SUMMARY



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**“It’s free. It’s accessible, and it’s beautiful. Parks are really important to life in Calgary.”**

– Citizen quote

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Calgary was founded at the confluence of two major rivers, a region that has served for millennia as a place of abundance and natural diversity. As Calgary grows, we have come to value and protect our natural heritage through building a great park system, and by taking steps to ensure that conservation is knitted into the fabric of our city. Calgarians consistently rank parks and open space as one of the city’s best qualities.

Calgary’s municipal government develops conservation policies and procedures to carry out the wishes of those who call Calgary home. As urban dwellers, we realize our individual sense of stewardship, and that of our community, is a key component to the success and health of Calgary’s environment. What we do as individuals is inextricably tied to the environment. For us to effectively steward our natural heritage, we must rely on our collective sense of ownership. We have the power of choice: to become aware, to act and to support.

This report is not a definitive assessment of Calgary’s biodiversity, but rather a documentation of what we currently know. It will be used to further our knowledge and understanding of our natural environment. In preparing this report we have developed a tangible record of what we have now, what we’ve lost, and what we need to prioritize in terms of education, conservation, preservation and collaboration initiatives. We can use this information to begin a conversation with each other on what we have, what’s important to protect, and how we grow as a city.

The report is presented in two parts. Part one, Calgary’s Biodiversity, addresses the status of Calgary’s biodiversity in terms of historical factors, as well as modern day realities and threats. Part two, Governance of Biodiversity, is a discussion of what The City and its environmental partners are doing to preserve what we currently have and, where possible, reclaim what may have already been lost.

What follows is an overview of the report.

# OVERVIEW

## ECOLOGY

Calgary is perched in a transitional Parkland on the western edge of the Canadian Prairies; part of the Great Plains Ecoregion of North America. The Grassland Natural Region stretches flat and dry to the east of the city (see Map 1 and 2). The rolling foothills foreshadow the rugged wilderness of the Rocky Mountains to the west. The city is at the confluence of two rivers, the Bow and the Elbow, and these river valleys are important natural wildlife corridors providing vital riparian and freshwater habitat. While changes in climate, early agricultural practices and subsequent urbanization have undoubtedly influenced the nature and number of plant and wildlife species that abound in the area, it's safe to say that as a society, we recognize and appreciate the ecological diversity we do have more and more.

As an overview of wildlife in Calgary, there are at least 52 mammal species, 365 bird species, six amphibian species, four reptile species and 22 fish species found here. Calgary also supports a variety of plant species that provide habitat and food for wildlife. Over 800 native species of plants have been observed here.

## GOVERNANCE

Our changing perceptions of what constitutes quality open space in Calgary have been dynamic. As the city became more of an established urban space in its own right – moving from a frontier land to a significant urban nexus – our understanding and appreciation for natural systems have grown.

A number of fundamental, long-term City plans and policy documents now direct growth in respect to the natural environment – as opposed to in place of it. Beyond ensuring the preservation of natural areas, green space and wildlife corridors, these guiding documents aim to ensure public accessibility, inter-connectivity and long-term sustainability of healthy ecosystems.

As examples, Calgary's urban forest is being strategically managed city wide. Integrated pest management represents a holistic approach to plant vitality. Corporate dividends from the public utility are directed to develop new parks. These are all clear priorities, as is water management. City government works together

with citizens, organizations and industry to protect the watershed itself, preserve and rehabilitate riparian zones, value regional wetlands, and minimize overall consumption.

## COLLABORATION AND INTEGRATION

Protecting and promoting Calgary's biodiversity is not the responsibility of any one City department, though historically, The City's Parks business unit has taken the lead. While working to articulate and mitigate their own potential environmental impacts, City departments also work together to ensure the best possible outcome for the greater good. From planning to implementation, in the office or in the field, when it comes to safeguarding the environment, there needs to be a shared consciousness and clear directive.

With its triple bottom line decision making framework, and other guiding principles, The City has effectively embedded environmental consciousness into corporate culture. Reinforcing the message day by day will go far to keep it top of mind.

## EDUCATION AND PARTICIPATION

Calgarians have the final say as to how effective our policies and best practices will ultimately prove at conserving Calgary's biodiversity. As municipal administrators, it makes good sense to invest in public education and encourage public participation in support of natural areas protection. And Calgarians are up to the task. Groups like the Calgary Field Naturalists (Nature Calgary) and the Calgary River Valleys forum have been proactive conservationists in Calgary for many decades. The City of Calgary has shown leadership in delivering environmental education programs, such as those at the Inglewood Bird Sanctuary and the annual Mayor's Environment Expo at City Hall. These programs, along with others, encourage schools, corporations, youth and families to become informed, involved and interested in assuming environmental leadership roles in the community-at-large.



# BIODIVERSITY

## OVERVIEW

Biodiversity can be defined as the variety of life and habitats in a given region. It encompasses all living organisms, such as birds, reptiles, mammals, insects and aquatic life, as well as plants and micro-organisms. This complex and fragile system connects us in the rich web of life.

Biodiversity can be considered at various levels. The simplest level is species diversity, which can be measured as the number of species in a given area. Biodiversity can also be considered in terms of genetic diversity within a species, either between individuals in the same population, or between different populations.

At a higher level, biodiversity can be considered in ecosystems, referring to the variety in species associations and relationships with their environment (Primack 2006).

Biodiversity can also be considered on different spatial scales. For example, species diversity can be examined within a local park, within the city of Calgary, the province, or even the entire planet, and each spatial scale will offer a different perspective of biodiversity. Factors that influence biodiversity must be considered on each of these scales if we are to better understand the impact of local decisions here in the city of Calgary, in the region, and globally. Biodiversity extends beyond our parks system into all facets of our lives.

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**Biodiversity can be defined as “...the variability among living organisms from all sources including, *inter alia* [among other things], terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. [Biodiversity] includes diversity within species, between species and of ecosystems.”**

— International Convention on Biological Diversity, 1992

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# BIODIVERSITY

## CALGARY'S BIODIVERSITY IN CONTEXT

Calgary lies within the Great Plains Ecoregion of North America (see Map 1), which is centrally located on the continent, with the city located in a transitional area that borders the Northern Forests Ecoregion.

When the glaciers began to retreat 14,000 years ago, they left behind glacial lakes, moraines and river valleys that shape the landscape we see today. The city of Calgary is on the western edge of the Canadian Prairies where the foothills extend to the Rocky Mountains. The transition between the prairies and the foothills has created a diverse landscape, which in turn builds a foundation for rich ecological diversity in our city.

Climate has a significant influence on diversity. The city's dry, continental climate, characterized by short, hot summers and long, cold winters, is due in part to its location within the rain shadow of the Rocky Mountains. These mountains limit humid air from the Pacific Ocean reaching Calgary. The relatively short growing season and scarcity of water has led to a landscape dominated by grasslands with forests that are naturally restricted to cool north-facing slopes and river margins where water is more abundant.

Map 1: Location of Calgary, Alberta, Canada in the Ecoregions of North America



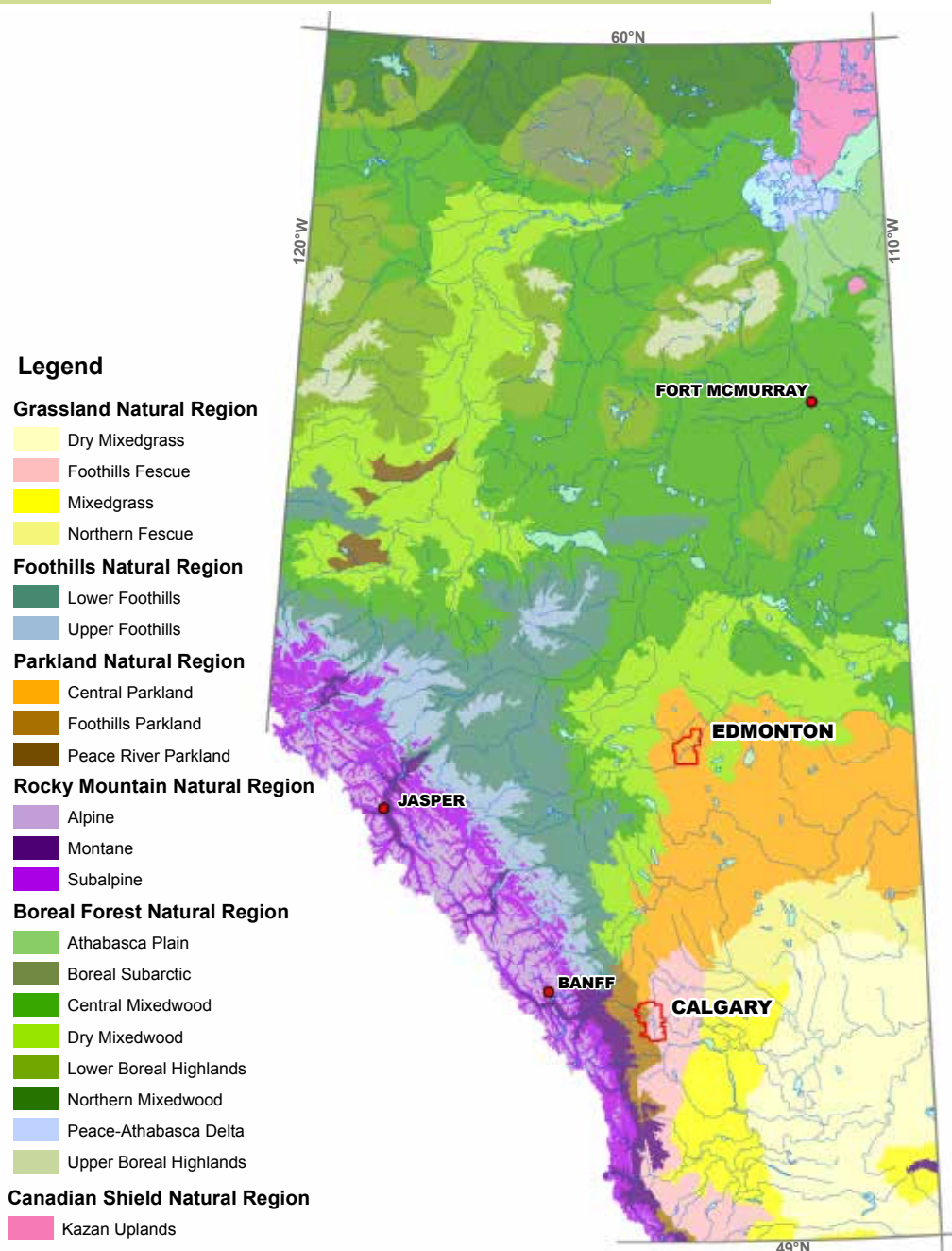
## CALGARY'S ECOLOGICAL CLASSIFICATION

The province of Alberta is classified into Natural Regions that mirror in greater detail the ecological classifications at national and continental scales. Calgary sits on a transition between the Parkland Natural Region to the west, and the Grassland Natural Region to the east. The western edge of the city is rolling, whereas the eastern edge is flatter and characteristic of the prairies.

The Parkland Natural Region is transitional between the cooler, moister boreal zones to the north, cordillera influences of the Rocky Mountains to the west, and the warmer, drier grasslands to the east (ACIMS 2011).

The Grassland Natural Region is the rolling to level part of Alberta often referred to as prairie, but shrubland are found in moister areas, with forest restricted to coulees and river valleys.

Map 2: The Natural Regions and Subregions of Alberta



# BIODIVERSITY

Humid Pacific air coming over the mountains influences local rainfall patterns, producing wet belts and rain shadows throughout the region. Arctic airflow from the north tends to be hindered resulting in mean temperatures during the summer months of 10 to 21 degrees Celsius. Standard temperatures of minus 23 to zero degrees Celsius occur throughout the winter, but temperatures can climb dramatically during episodes of chinook winds from the west. Due to the vast difference in the region's terrain, annual precipitation can range from 1,600 mm in the north to 250-500mm in south.

The region has had its landscape altered through recreation, agriculture, grazing, and the oil and gas industry, with only a small proportion of native grasslands and Parkland vegetation remaining. Within Calgary, many of the city's natural areas have had similar disturbances. This elevates the importance of the remaining native habitat.

## CALGARY'S WATERSHEDS

Calgary is within the Bow River and Red Deer River Sub-basins of the South Saskatchewan River watershed. While the very northeast corner of the city lies within the Red Deer River Sub-basin, most of the city is within the Bow River Sub-basin. The headwaters of the Bow River begin on the eastern edge of the continental divide and flow east through the foothills. Continuing east, the Bow River joins other rivers such as the Elbow, Oldman, Red Deer and others, becoming the South Saskatchewan River, which cuts across the prairies and ultimately empties into Hudson Bay in Central Canada via the Nelson River.

The Bow River Sub-basin is the most densely populated watershed in all of Alberta. Natural wildlife corridors occur along Calgary's major river valleys, smaller creeks and wetland complexes. These provide vital riparian and freshwater habitat.

Map 3: Calgary's location relative to two sub-watersheds of the South Saskatchewan River





## CALGARY'S HABITAT TYPES

Plant communities in Calgary are strongly influenced by water availability. Historically, on dry, rapidly draining south-facing slopes, rough fescue, Parry's oatgrass and porcupine grass were dominant. On more moist and moderately well-drained north-facing slopes, seepage areas and low-lying areas typically have aspen forests with an understory of snowberry, prickly rose or saskatoon. On imperfectly drained soils, willow shrublands are more common. Understory associated with these willow shrublands include red raspberry, white geranium and other tall forbs. Along rivers, balsam poplar stands with shrubby understories are common.

Short grass prairie is typical for the Calgary area. The predominance of fescue prairie, a result of a generally dry climate, was historically maintained by bison grazing and fire, which was used by First Nations people for habitat management and hunting. Since European settlement in the late 19th century, much of the prairie has disappeared due to agricultural conversion and fire suppression.

Only one per cent of this region consists of open water, with the Bow River being the largest watercourse. Wetlands are uncommon, representing just four per cent of the region.

## ASPEN FORESTS



Trembling aspen is one of the most widely distributed tree species in North America. Aspen forest is found in both isolated clusters and in more contiguous forests. It is the dominant tree in the Foothills Parkland Natural Subregion, and tends to develop in well-drained, moist sites, particularly on sheltered north-facing slopes, hills and in ravines.

Aspen are frequently found in association with other tree species: balsam poplar in riverine lowlands and moist depressions, and white spruce on cooler, north-facing riverine slopes. Typical understory species in undisturbed sites include saskatoon, wild rose, red-osier dogwood and snowberry.

Disturbed sites are common, and the understorey vegetation in these areas is typically dominated by invasive agronomic species such as smooth brome.

# BIODIVERSITY

## BALSAM POPLAR FORESTS



Balsam poplar forest is a common riparian forest type in Calgary. Riverine cottonwood forests are common in the Bow River watershed (and elsewhere within southern Alberta) on exposed point bars of the Bow and Elbow rivers. Balsam poplar is the dominant tree. It requires moist, gravelly soils to establish and grow, and is typically dependent upon annual flooding in the spring and summer to thrive. Minor occurrences of this habitat type are also found in upland areas with a permanent water source, such as springs or seeps, intermittent creeks and local depressions. Typical understory vegetation include species such as red-osier dogwood, various species of willow, water birch, silverberry and Canada buffalo berry.

Balsam poplar forests are declining throughout southern Alberta and across the Prairie provinces and the American Midwest. The primary cause of this decline has been linked to irrigation, flood prevention measures and hydroelectric developments which have altered the natural hydrological regime of rivers, preventing the disposition of fresh silt during floods, when seeds, which have a short germination period, are dispersing. In urban areas, this has been compounded by development and other human uses altering the floodplain.

## WHITE SPRUCE FORESTS



In this region, white spruce forests are found only on relatively cool, north-facing riverine slopes and floodplains where there is adequate moisture. In Calgary, this habitat type is restricted to steep, north-facing slopes along the Bow and Elbow rivers, and scattered ravine systems in the west.

Mature spruce forests and floodplains form dense canopies that allow for very little light penetration, resulting in an open understory. Undisturbed sites will typically have a feather moss carpet and scattered herbaceous plants. Patch disturbance from fallen or dead trees creates opportunities for light-seeking plants to establish.

Spruce forests often occur in mixed stands with balsam poplar and aspen in the Calgary region. Minor occurrences of Douglas fir forest can be found along the Bow River. This species is very uncommon east of the continental divide and these stands constitute some of the eastern-most locations in Canada.

## GRASSLANDS



Grassland habitats develop in warmer sites where moisture is limited. It is the dominant habitat type in Calgary, most commonly found on south-facing slopes in the area. Prior to European settlement in the latter half of the 19th century, most of Calgary was dominated by rough fescue grassland. As a result of widespread agricultural conversion throughout the 19th and 20th centuries, and urban development starting in the early 20th century, nearly all the native prairie grassland in the Calgary region has been lost, although remnant patches can still be found in some places within the city.

Grass species such as blue grama, June grass, needle-and-thread grass, and several species of wheat grass are common on warmer exposed slopes. Rough fescue grassland is rare in Calgary (and throughout the Prairie provinces). In Calgary, the best examples of this community are in Nose Hill Park and Haskayne Park. Native grasslands are known for their rich array of flowering plants, such as crocus and buffalo-bean, which flower in early spring, and blanket flower and goldenrods, which bloom in late summer.

Non-native grassland is less diverse. Most non-native grasslands are dominated by invasive grass species such as smooth brome and Kentucky bluegrass. Both thrive in Calgary's climate and will out-compete native species, forming dense, almost mono-specific stands as they encroach upon, and ultimately replace native grassland.

Although they are less diverse, these sites do have habitat value for a variety of wildlife species, including magpie, white-tailed deer and jackrabbit, which are common in the city.

## RIPARIAN/RIVERINE AREAS



Host to a mix of wetland and upland vegetation, riparian zones are important transition areas between water and land. In the Calgary region, riparian zones are dominated by a mix of balsam poplar forests along major rivers, a diverse mix of willows and other shrubby species, and gravel/sand bars and shoulders occurring along major rivers.

Riparian areas are highly productive vegetation zones with considerable diversity of vegetation. They provide important habitat to resident and migratory wildlife, and play an essential role in watershed protection and management.

# BIODIVERSITY

## WETLANDS



Wetlands are transitional ecosystems between upland and water, where the water table is at or above the surface. Wetlands develop distinct soils and vegetation. Prairie wetlands are internationally important areas for breeding, staging and nesting for migratory birds and waterfowl. They provide critical habitat for many species of wildlife.

Wetlands in the Calgary area range from ephemeral ponds that may only hold water for a few hours after a storm, to large open water ponds that stay full throughout the year. However, most wetlands are seasonal and may only hold water a few months a year. Emergent vegetation such as cattail, bulrushes and sedges, tend to dominate at these sites.

On the eastern edge of the city, saline (alkali) wetlands are common. These wetlands are characterized by their high salt content (giving them a white appearance when they are dry) and unique plant communities that are adaptive to these saline conditions.

In 2001, The City of Calgary conducted an inventory of wetlands and concluded that, as a measure of land area, more than 90 per cent of Calgary's wetlands have been lost to development.

Habitat types are described by The City of Calgary Biophysical Inventory update (Fiera 2011), and associated vegetation communities are described in more detail in the Calgary Natural Area Management Plan (1994).

### Natural Habitats

Habitat Category	Habitat Type
Forests	Aspen Forest
	Balsam Poplar Forest
	Douglas Fir Forest
	White Spruce Forest
Grasslands	Grassland
Shrublands	Upland Low Shrub
	Upland Tall Shrub
	Riparian Tall Shrub
Riparian/Riverine Areas	Major Rivers Open Water
	Streams Open Water
	Riparian Gravel/Sand Shoulders
Wetlands	Wetland Open Water
	Wetland Emergent Vegetation

### Semi-Natural Habitats

Habitat Type	Disturbance Type
Disturbed Areas	Golf Courses
	Agricultural Annual Crops
	Agricultural Pasture/Fallow
	Major Rights-of-Ways
	Manicured Greenspace – Open
	Manicured Greenspace – Treed
	Storm Ponds/Reservoirs

### Built Habitats

Habitat Type	Disturbance Type
Disturbed Areas	Rural Homesteads
	Low Density Residential
	Community Development
	Commercial
	Industrial Hard Surface
	Industrial Bare Ground
	Construction Bare Ground
	Major Transportation Corridors



## COMMON SPECIES OF THE CALGARY REGION

The grizzly bear, grey wolf and American bison historically roamed the grasslands of Alberta, but were extirpated from overhunting and habitat loss. The most common large mammals found within the Calgary area now include the coyote and white-tailed deer.

Calgary's species diversity is presented in Appendix 2, which includes a listing for all mammals, birds, reptiles, amphibians and fish species known to occur in the city, as well as a summary of the invertebrates, vascular and non-vascular plants and fungi.

The following section presents an overview of some species that are commonly observed in Calgary: species known to be part of our natural heritage.

## PLANTS

There are almost 850 species of non-cultivated vascular plants known to occur in Calgary, as well as about 100 non-vascular species. Of these 950 plants, almost 150 are exotic species, which includes 54 species of trees and shrubs not naturally occurring in Calgary, but planted as part of the city's urban forest. Highlights of vascular plant species are listed below.

### Balsam poplar (*Populus balsamifera*)



This large deciduous tree is commonly found in Calgary's river valleys and other areas with a high water table. Balsam poplars are excellent wildlife trees, with the large branches of older trees providing nesting and perching sites for birds; deep furrows in the bark providing feeding sites for insect-eating birds; sloughing bark providing habitat for bats and brown creepers; and the hardwood consumed by beavers and excavated by cavity-nesting birds. This tree species reproduces by producing plenty of seeds and grows root suckers to form clones. In Calgary, where dams control river flood levels and change the water table, balsam poplar reproduction has slowed. Combined with its relatively short lifespan, slowed reproduction may affect future wildlife habitat.

# BIODIVERSITY

**Douglas fir** (*Pseudotsuga menziesii*)



Normally found in montane regions and growing up to 80 metres tall, Douglas fir is at the eastern edge of its range in Calgary. Found only on shady, north-facing slopes along the Bow River on the west side of the city, this evergreen reaches about 50 metres in height. Douglas fir are excellent wildlife trees. Insectivorous birds feed on insects that hide in the thick, deeply furrowed bark. Deer browse on twigs; birds, chipmunks and deer mice eat the seeds. Large witches' brooms (dense masses of shoots growing from a single point) act as nesting and roosting sites for owls. Woodpeckers excavate cavity nests into dead or dying trees, allowing secondary cavity users to occupy them afterwards. Sloughing bark protects perching sites from climbing predators. Both drought and fire resistant due to its very thick bark, a single tree can live up to 400 years in Alberta, providing many centuries of wildlife habitat.

**Saskatoon** (*Amelanchier alnifolia*)



This deciduous plant can grow as a shrub or a small tree, and is often found in shrubby or wooded areas. Its white flowers produce purple berry-like pome fruits known as saskatoon "berries," which are valued forage for birds and mammals. The fruits were traditionally used by First Nations people in cakes as a winter food supply, or as an addition to pemmican, meat stews and soups. They are now cooked into jams and pies with fruit harvested from orchards. Saskatoon twigs are also an important winter browse for many ungulates.

**Prickly rose** (*Rosa acicularis*)



The prickly rose gets its name as a result of its numerous thorns. As the floral emblem of Alberta it is also known as the wild rose. This aromatic pink flowered shrub is found in open woods, along rivers and in moist grasslands. Prickly rose fruit are red and pear-shaped and known as rose hips. Because they are very high in vitamins A and C, hips were often consumed by First Nations people as an ingredient in pemmican, or eaten roasted or raw.

**Western blue flag** (*Iris missouriensis*)



The blue-lilac flowered iris is a perennial monocot with long, thin leaves and thick, underground roots called rhizomes that allow it to form colonies. Occasionally found in wet open meadows and streambanks, this species is rare in Alberta, with the northern limit of its range extending just across the Montana border along the eastern slopes of the Rocky Mountains. There are, however, currently two known introduced populations in Calgary. It is listed as “Sensitive” in Alberta’s General Status of Wild Species Report (ASRD 2011), and listed as “Threatened” on Schedule 1 of the *Species at Risk Act* (SARA 2011). (See tables, 1, 2 and 3 for details on SARA, p. 22-23.)

**Rough fescue** (*Festuca campestris*)



The grass emblem of Alberta, this tufted perennial can reach over a metre in height. The name “rough” fescue comes from its thin blue-green roughened leaves. It dominates the remnant native grasslands of Nose Hill Park, and is the dominant grass species in the Foothills Fescue Natural Subregion, as well the moderately moist grasslands of the Foothills Parkland Natural Subregion. Rough fescue provides cover for small wildlife. Historically, it supported American bison populations through the winter by providing high-quality forage that could be reached through the snow. Its fibrous roots help support the thick organic soil layer of the most biologically productive soil zone in western Canada, the Black Soil Zone. Significant losses in native fescue grassland have occurred over time after extensive cultivation.



# BIODIVERSITY

## WILDLIFE

Calgary is home to a diversity of wildlife species. Approximately 52 mammals, 365 birds, six amphibians, four reptiles and 22 fish species have been recorded within the Calgary area. Of these approximately 450 species, 83 species do not naturally occur in the Calgary area. Calgary's diversity of wildlife species can be attributed to a number of factors, including its geographic location amongst a unique complexity of landscape characteristics, its location within two of the four North American Migration Flyways, and its occurrence within three natural sub-regions (see Map 2). The City of Calgary continues to be actively involved with the conservation of wildlife species through the management of parks, research projects and ongoing programs that support wildlife awareness and protection.

### a. MAMMALS

Approximately 52 mammal species are known to occur in Calgary, ranging from small mammals such as mice, bats and weasels, to larger species such as coyotes, deer and the occasional moose or black bear. Profiles of three common mammals occurring in Calgary follow.

#### Richardson's ground squirrel (*Spermophilus richardsonii*)



The Richardson's ground squirrel (more commonly referred to as "gopher," although not a true gopher) is a medium-sized ground-dwelling mammal found in short-grass habitats throughout the city. Living in loose colonies, this species hibernates in complex underground burrows. Richardson's ground squirrel is considered a 'keystone' species in the Canadian prairies, and is a vital source of prey for birds of prey, weasels, badgers and coyotes. Their burrowing is important in soil formation and also provides habitat for a variety of species including burrowing owls, reptiles and some insects. They are also regarded as an agricultural pest and are controlled in Calgary where their burrows are considered to be a safety hazard.



# BIODIVERSITY

**Coyote** (*Canis latrans*)



Due to their highly adaptable nature, coyotes are found in all regions and terrestrial habitats of Alberta, and are becoming increasingly common in urban settings. Coyotes are opportunistic, feeding on a variety of animal and plant food. Human encounters with coyotes in Calgary are on the rise, as coyotes continue to search for urban food sources such as garbage. A number of coyote research projects are under way to better understand the movement patterns and behaviours of this species within the city.

**White-tailed deer** (*Odocoileus virginianus*)



The white-tailed deer is Alberta's most abundant hoofed wild animal, its range extending from the southern to the northern reaches of the province. Similar to other mammals of Alberta, agricultural development and forest fragmentation have been favourable to the white-tailed deer. This species browses on trees and shrubs in the winter, followed by forbs and grasses in the summer. In Calgary, white-tailed deer are often observed within forested habitats along the Bow and Elbow rivers, and within aspen groves and coulees, such as those in Nose Hill Park.

# BIODIVERSITY

## b. BIRDS

There have been 365 species of birds observed in the Calgary area, with 70 being accidental/vagrant in occurrence (birds that have strayed far outside of their expected range). Some common bird species within Calgary include the great horned owl, Canada goose, mallard, black-billed magpie and black-capped chickadee. Three species profiles follow.

### Juvenile great horned owl (*Bubo virginianus*)



The great horned owl, Alberta's provincial bird, is one of the most widespread and common owls in North America. It is found in a variety of habitats in both urban and rural areas, nesting in large abandoned stick nests of other birds, as well as atop cliffs and buildings. Although common within Calgary, this owl is difficult to detect, as it is relatively inactive during daylight hours, hunting primarily at night. While this efficient predator feeds mainly on small mammals, it will also prey on birds, amphibians, reptiles and invertebrates.

### American white pelican (*Pelecanus erythrorhynchos*)



American white pelicans can be observed within Calgary during spring and fall migration, while enroute to and from their nesting grounds in eastern Alberta. Pelicans often fish co-operatively, moving into a circle and herding fish into schools before dipping their heads under water to scoop them up. In past years, fishing pelicans have congregated near the Bow River weir located slightly downstream of the Calgary Zoo, due to high concentrations of fish unable to travel across the weir. However, recent reconstruction of the weir has enabled fish passage, resulting in the dispersal of pelicans farther up and downstream of the area. These birds are vulnerable to disturbance near their breeding sites, thus the number of active breeding colonies has declined. Alberta Environment and Sustainable Resource Development (ESRD) has listed the species as "Sensitive" (see Table 1 for details).

### Yellow warbler (*Dendroica petechia*)



The yellow warbler is a common migratory songbird, breeding in a variety of shrubby habitats throughout the province. Due to its bright yellow plumage, this bird is often mistaken as a wild "yellow canary," however, no such species exists. The yellow warbler frequents shrubby riparian areas in Calgary, such as those bordering the Bow and Elbow rivers, and can often be observed in parks such as Weaselhead, Bowmont and the Inglewood Bird Sanctuary. (see Appendix 2 for park profiles.)



## c. AMPHIBIANS, REPTILES AND FISH

Calgary has six species of amphibians, four species of reptiles and 22 species of fish. Some are profiled below.

### Boreal chorus frog (*Pseudacris maculata*)



The smallest and most widespread amphibian in the province, the boreal chorus frog resides in more habitat types than any other Canadian frog (Fisher *et al.* 2007). Boreal chorus frogs are primarily terrestrial; however, they are commonly found during the spring in almost any body of water, where males can be heard calling, a sound that is similar to running your fingernail along the teeth of a comb.

### Plains garter snake (*Thamnophis radix*)



The plains garter snake is one of three snake species that occur in Calgary (along with red-sided and wandering garter snakes). They occur in a wide variety of habitat types, often frequenting aquatic areas. This snake hibernates communally in rock crevices, animal burrows or natural sinkholes. Plains garter snakes are common within Calgary, providing an important prey species to raptors and weasels. Several shelters are known to occur throughout the city.

### Bull trout (*Salvelinus confluentus*)



The bull trout, Alberta's provincial fish, was once a common species found in all streams and headwaters in the eastern slopes of the Rocky Mountains but is now a rare sight in the Bow River. Alberta Environment and Sustainable Resource Development (ESRD) currently lists the bull trout as *Sensitive*. The vulnerability of bull trout spawning sites to disturbance and predators, overfishing and the loss of habitat are factors known to have contributed to a decline in numbers and distribution. There is now a zero possession limit on bull trout throughout the province. This means all bull trout caught in Alberta must be released.

# BIODIVERSITY

## POPULATION STATUS OF CALGARY'S PLANTS AND WILDLIFE

### INTRODUCTION TO SPECIES STATUS

Species at risk are the most vulnerable components of Alberta's biodiversity. As wild species are a keystone to healthy ecological processes, the integrity of Alberta's ecosystems is dependent on healthy populations. There are both provincial and federal strategies in place to aid in the management and protection of species at risk.

Although the majority of wild species are secure, some populations are at risk for a variety of reasons. These species are tracked provincially through Alberta's General Status of Wildlife Species Report, and/or federally through the List of Wildlife Species at Risk, a schedule of the *Species at Risk Act* (SARA) which designates species according to status in Canada.

### PROVINCIAL STATUS

Alberta Environment and Sustainable Resource Development (ESRD) is responsible for the general status of wild species in the province. Every five years, ESRD evaluates the status of Alberta's wild species, cataloguing species into one of nine categories (see Table 1). Updates to species information are available in the "General Status of Alberta Wild Species 2010" searchable database.

### FEDERAL STATUS

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC), determines the national status of Canadian species in accordance with the *Species at Risk Act* (SARA) and the Accord for the Protection of Species at Risk. COSEWIC publishes status assessments and reports them to the public and federal government. The recommendation may be considered by the Minister of Environment in designating species at risk. Status designations are shown in Table 2.

**Table 1: Alberta Government definitions of general status categories (ESRD 2011)**

General status rank	Definitions
At Risk	Any species known to be at risk after formal detailed status assessment and legal designation as Endangered or Threatened in Alberta.
May Be At Risk	Any species that may be at risk of extinction or extirpation, and is therefore a candidate for detailed risk assessment.
Sensitive	Any species that is not at risk of extinction or extirpation but may require special attention or protection to prevent it from becoming at risk.
Secure	A species that is not At Risk, May Be At Risk or Sensitive.
Undetermined	Any species for which insufficient information, knowledge or data is available to reliably evaluate its general status.
Not Assessed	Any species that has not been examined during this exercise.
Exotic / Alien	Any species that has been introduced as a result of human activities.
Extirpated / Extinct	Any species no longer thought to be present in Alberta (Extirpated) or no longer believed to be present anywhere in the world (Extinct).
Accidental / Vagrant	Any species occurring infrequently and unpredictably in Alberta, i.e. outside its usual range.

**Table 2: Species status according to List of Wildlife Species at Risk (COSEWIC 2011)**

Status	Definitions
Endangered	A species facing imminent extirpation or extinction.
Threatened	A species likely to become endangered if limiting factors are not reversed.
Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.
Not at Risk	A species that has been evaluated and found to be not at risk.



## SPECIES AT RISK ACT

The *Species at Risk Act* (SARA) became official legislation in 2002, a result of the implementation of the Canadian Biodiversity Strategy (Environment Canada 2012; SARA 2011). The purpose of the *Species at Risk Act* is to prevent indigenous Canadian species and distinct populations from becoming extirpated or extinct, to provide recovery for endangered or threatened species, and to prevent other species from becoming at risk.

The *Species at Risk Act* establishes Schedule 1 as the official list of species at risk. Species listed under Schedule 1 are classified as extirpated, endangered, threatened, or special concern. Once listed, species are legally protected, and measures are implemented for their recovery. Species that are listed in Schedules 2 and 3 must be assessed by COSEWIC within a given timeframe. Although not included on the official list of species at risk, these species follow the same process for assessment and classification. Table 3 describes the SARA status categories.

**Table 3: Species status according to the *Species at Risk Act* (SARA 2011)**

Status	Definitions
Schedule 1	A species has been assessed by COSEWIC and the listing provided from COSEWIC has been accepted by the Minister of the Environment. <b>These species are now protected legally under SARA and recovery planning is mandatory.</b>
Schedule 2	A species is not on the official SARA list; however, the status of the species must be assessed within a given timeframe. <b>These species are listed as endangered or threatened by COSEWIC.</b>
Schedule 3	A species is not on the official SARA list; however, the status of the species must be assessed within a given timeframe. <b>These species are listed as species of special concern by COSEWIC.</b>
Data Deficient	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment, or (b) to permit an assessment of the wildlife species' risk of extinction.

## SPECIES PROFILE: NORTHERN LEOPARD FROG

Northern leopard frogs are listed as At Risk in Alberta and are federally listed as *Threatened* in Schedule 1 of SARA (COSEWIC 2011; SARA 2011). Once a common amphibian of central and southern Alberta, this frog experienced a dramatic range contraction and population declines in the late 1970s (Alberta Conservation Association and Alberta Sustainable Resource Development 2006). Historically, the northern leopard frog was common within several natural areas in Calgary, with a number of detections recorded in riparian habitats adjacent to the Bow River (FWMIS 2011). However, the northern leopard frog has not been recorded within Calgary since 2003. Although there is limited understanding for this decline, habitat degradation and loss, disease and pollution are believed to be contributing factors.



Table 4 on the following page lists the species of local birds, mammals, amphibians, reptiles and fish with populations that are currently listed as Sensitive, May Be at Risk, or At Risk by ESRD and or are federally listed under SARA. Table 5 includes the listed species of local vascular and non-vascular plants, of which one tree and one shrub do not naturally occur in the region, but are planted as part of the city's urban forest.

# BIODIVERSITY

**Table 4: Calgary's wildlife species at risk**

Species	ESRD Status	COSEWIC** 2011 Status	SARA*** 2011 Status
<b>BIRDS</b>			
Peregrine falcon	At Risk	Threatened	
Piping plover	At Risk	Endangered	Schedule 1
Trumpeter swan	At Risk		
*Whooping crane	At Risk	Endangered	Schedule 1
Clark's grebe	May be at Risk		
Olive-sided flycatcher	May be at Risk	Threatened	Schedule 1
Red knot	May be at Risk		
Short-eared owl	May be at Risk	Special Concern	Schedule 3
American bittern	Sensitive		
American kestrel	Sensitive		
American white pelican	Sensitive		
Baird's sparrow	Sensitive		
Bald eagle	Sensitive		
Baltimore oriole	Sensitive		
Barn swallow	Sensitive	Threatened	
Barred owl	Sensitive		
Bay-breasted warbler	Sensitive		
Black tern	Sensitive		
Black-backed woodpecker	Sensitive		
*Blackburnian warbler	Sensitive		
Black-crowned night-heron	Sensitive		
Black-necked stilt	Sensitive		
Black-throated green warbler	Sensitive		
Bobolink	Sensitive	Threatened	
Brewer's sparrow	Sensitive		
Broad-winged hawk	Sensitive		
Brown creeper	Sensitive		
Canada warbler	Sensitive	Threatened	Schedule 1
Cape May warbler	Sensitive		
Caspian tern	Sensitive		
Chestnut-collared longspur	Sensitive	Threatened	
Clark's nutcracker	Sensitive		
Common nighthawk	Sensitive	Threatened	Schedule 1
Common yellowthroat	Sensitive		
Eastern phoebe	Sensitive		
Forster's tern	Sensitive		
Golden eagle	Sensitive		
Grasshopper sparrow	Sensitive		
Great blue heron	Sensitive		
Great gray owl	Sensitive		
*Great-crested flycatcher	Sensitive		
Green-winged teal	Sensitive		

**Table 4: Calgary's wildlife species at risk**

Species	ESRD Status	COSEWIC** 2011 Status	SARA*** 2011 Status
<b>BIRDS continued</b>			
Harlequin duck	Sensitive		
Horned grebe	Sensitive	Special Concern	
Least flycatcher	Sensitive		
Lesser scaup	Sensitive		
*Lewis's woodpecker	Sensitive		
Loggerhead shrike	Sensitive	Threatened	Schedule 1
Long-billed curlew	Sensitive	Special Concern	Schedule 1
Northern goshawk	Sensitive		
Northern harrier	Sensitive		
Northern pintail	Sensitive		
Northern pygmy-owl	Sensitive		
Osprey	Sensitive		
Pied-billed grebe	Sensitive		
Pileated woodpecker	Sensitive		
Prairie falcon	Sensitive		
Purple martin	Sensitive		
Rusty blackbird	Sensitive	Special Concern	Schedule 1
Sandhill crane	Sensitive		
*Sedge wren	Sensitive		
Sharp-tailed grouse	Sensitive		
Sora	Sensitive		
Sprague's pipit	Sensitive	Threatened	Schedule 1
Swainson's hawk	Sensitive		
Upland sandpiper	Sensitive		
Western grebe	Sensitive		
Western tanager	Sensitive		
Western wood-pewee	Sensitive		
White-faced ibis	Sensitive		
White-winged scoter	Sensitive		
Yellow rail	Undetermined	Special Concern	Schedule 1

# BIODIVERSITY

**Table 4: Calgary's wildlife species at risk**

Species	ESRD Status	COSEWIC** 2011 Status	SARA*** 2011 Status
<b>MAMMALS</b>			
Long-eared bat	May be at Risk		
Long-tailed weasel	May be at Risk		
Badger	Sensitive		
Bobcat	Sensitive		
Canada lynx	Sensitive		
Cougar	Sensitive		
Hoary bat	Sensitive		
Red bat	Sensitive		
Silver-haired bat	Sensitive		
Western small-footed bat	Sensitive		
<b>AMPHIBIANS</b>			
Northern leopard frog	At Risk	Threatened	Schedule 1
Canadian toad	May be at Risk	Not at Risk	
Western toad	Sensitive	Special Concern	Schedule 1
<b>REPTILES</b>			
Common garter snake	Sensitive		
Plains garter snake	Sensitive		
Terrestrial garter snake	Sensitive		
Western painted turtle	Sensitive	Not at Risk	
<b>FISH</b>			
Bull trout	Sensitive		

\*Accidental species (have been occasionally recorded in the region, but are considered to be outside of their normal range).

\*\*COSEWIC – Committee on the Status of Endangered Wildlife in Canada.

\*\*\*SARA – *Species At Risk Act*



**Table 5: Calgary's plant species at risk**

Species	ESRD Status	COSEWIC** 2011 Status	SARA*** 2011 Status
<b>FORBS (Herbaceous flowering plants)</b>			
Clammyweed	May Be At Risk		
Common dodder	May Be At Risk		
Eaton's aster	May Be At Risk		
Geyer's onion	May Be At Risk		
Low braya	May Be At Risk		
Low townsendia	May Be At Risk		
Low yellow evening-primrose	May Be At Risk		
Tall blue lettuce	May Be At Risk		
Two-leaved waterweed	May Be At Risk		
Waterpod	May Be At Risk		
Western false gromwell	May Be At Risk		
Yellow cress	May Be At Risk		
American winter cress	Sensitive		
Yellow lady's slipper	Sensitive		
Glaucous willow herb	Sensitive		
Few-flowered aster	Sensitive		
Fringed gentian	Sensitive		
Indian breadroot	Sensitive		
Long-fruited wild parsley	Sensitive		
Mountain wild parsnip	Sensitive		
Northern fringed gentian	Sensitive		
Pale blue-eyed grass	Sensitive		
Purple peavine	Sensitive		
Squawroot	Sensitive		
Tall white bog orchid	Sensitive		
Western blue flag	Sensitive	Special Concern	Special Concern
Bur-reed	May Be At Risk		
Crowfoot violet	May Be At Risk		
Early buttercup	May Be At Risk		
Macoun's cinquefoil	May Be At Risk		
Water speedwell	May Be At Risk		
Clammy hedge-hyssop	Sensitive		
Pin-cushion plant	Sensitive		
Seneca snakeroot	Sensitive		
Spotted coralroot	Sensitive		
Stiff yellow paintbrush	Sensitive		

# BIODIVERSITY

**Table 5: Calgary's plant species at risk**

Species	ESRD Status	COSEWIC** 2011 Status	SARA*** 2011 Status
Widgeon-grass	Sensitive		
<b>GRASSES</b>			
Marsh muhly	May Be At Risk		
Prairie wedge grass	May Be At Risk		
Brook grass	Sensitive		
Little bluestem	Sensitive		
Porcupine grass	Sensitive		
<b>SEDGES</b>			
Crawe's sedge	May Be At Risk		
Beaked sedge	Sensitive		
<b>SHRUB</b>			
*Mock orange	May Be At Risk		
<b>TREES</b>			
Limber pine	May Be At Risk		
Green ash	May Be At Risk		
Narrow-leaf cottonwood	Sensitive		
Plains cottonwood	Sensitive		
Peach-leaved willow	Sensitive		
*Butternut		Endangered	Schedule 1
<b>MOSSES</b>			
Bird's claw screw moss	Sensitive		
Bladder-cap moss	Sensitive		
<i>Bryum pallescens</i>	Sensitive		
<i>Calliergonella cuspidata</i>	Sensitive		
<i>Hypnum cupressiforme</i>	Sensitive		
<i>Platygyrium repens</i>	Sensitive		
<b>LICHEN</b>			
Fan ramalina	Sensitive		

\*Planted as part of the city's urban forest, but not naturally occurring.

\*\*COSEWIC – Committee on the Status of Endangered Wildlife in Canada.

\*\*\*SARA – Species At Risk Act.

## HISTORIC INFLUENCES

Changes in biodiversity through the loss and arrival of species are a natural process. Some change is attributable to human activities going back to the 8,000 years of known human occupation in the region. However, through journal transcripts, we have a much better understanding of changes that have occurred since the arrival of Europeans in North America, first as fur traders, and eventually as settlers in the latter half of the 19th century.

## EARLY SETTLEMENT

Archaeological evidence points to the earliest human presence in the Calgary region shortly after the glaciers melted some 11,000 – 12,000 years ago. Small, nomadic bands of what archaeologists refer to as Paleo-Indians roamed the region hunting large game, such as Pleistocene mammals, mammoths and the Great Plains bison which featured prominently in their culture and mythology. As the climate warmed, human populations were growing and the larger mammals faced extinction. The hunters moved across the prairies, shadowing the path of Great Plains bison herds as they grazed the open plains from season to season.

For thousands of years these nomadic hunters evolved their unique culture and refined their skills in step with the environment in which they lived. Aboriginals from the Parkland regions were subsistence trappers relying on fur-bearing animals such as beaver and muskrat. Plains peoples relied more heavily on hunting large game, using the dramatic topography of steep escarpments to their advantage. For example, Head-Smashed-In Buffalo Jump in southern Alberta is a well-documented kill site. Signs of large-scale bison kills and artifacts from native encampments have also been identified on the Paskapoo Slopes in Calgary's northwest and Fish Creek Provincial Park in the south. These date back approximately 2,500 years.

With travel came trade, conflict, the spread of disease and resettlement. Starting in 1871 the First Nations of Western Canada began to sign treaties with the Crown, which allowed settlement of non-Aboriginal Canadians on the lands, in exchange for monies, reserve lands, education and farming assistance. Treaty 7 was signed in 1877 between the tribes of the Blackfoot Confederacy, Tsuu T'ina, Stoney Nations and the Crown, and included much of the lands of southern Alberta, including Calgary.

One of the earliest documented European contacts with First Nations people in the Calgary area was in 1787. David Thompson wrote in his journal about spending the winter encamped with the Blackfoot along the Bow River. It is one of the two major rivers that flow through present day Calgary, or Kootisaw, "meeting of the waters," as the Sarcee called the area.

The first European settlement at what is now Calgary was in 1875 when a detachment of the North West Mounted Police arrived and established Fort Calgary at the confluence of the Bow and Elbow rivers. They were assigned to the area to oversee the fur trade and protect the Western Plains and the First Nations people from American whiskey traders. The community rapidly grew around the Fort, in anticipation of the arrival of a transcontinental railroad.

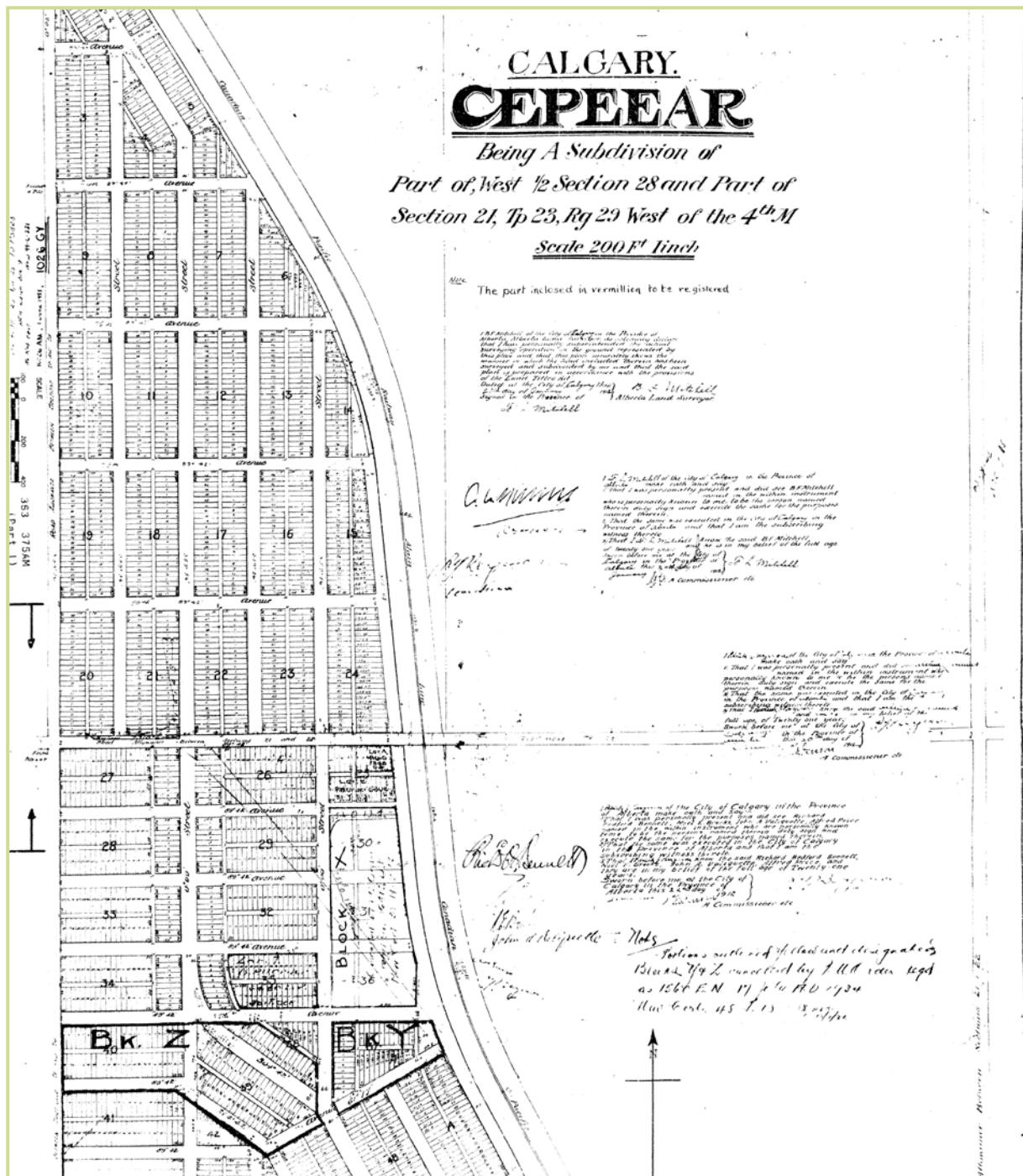
The Canadian Pacific Railway reached Calgary in 1883, and a train station was built one mile west of the existing settlement, effectively moving the centre of Calgary with it. The railroad, and the people it brought west, would transform the area into an important commercial and agricultural centre.

# BIODIVERSITY

## BIRTH OF THE CITY

Calgary was officially incorporated as a town in 1884 with a population of 428. The Dominion Government began granting leasing rights for animal grazing. Agriculture and ranching became key components of the local economy, and as such, began to shape Calgary's spatial form.

Around the turn of the century civic leaders were feeling optimistic in Calgary's growth potential and began expanding township limits and investing in necessary infrastructure, including parks. A "Greater Calgary," including recreational activities and public gardens, was going to be a beautiful place to live.



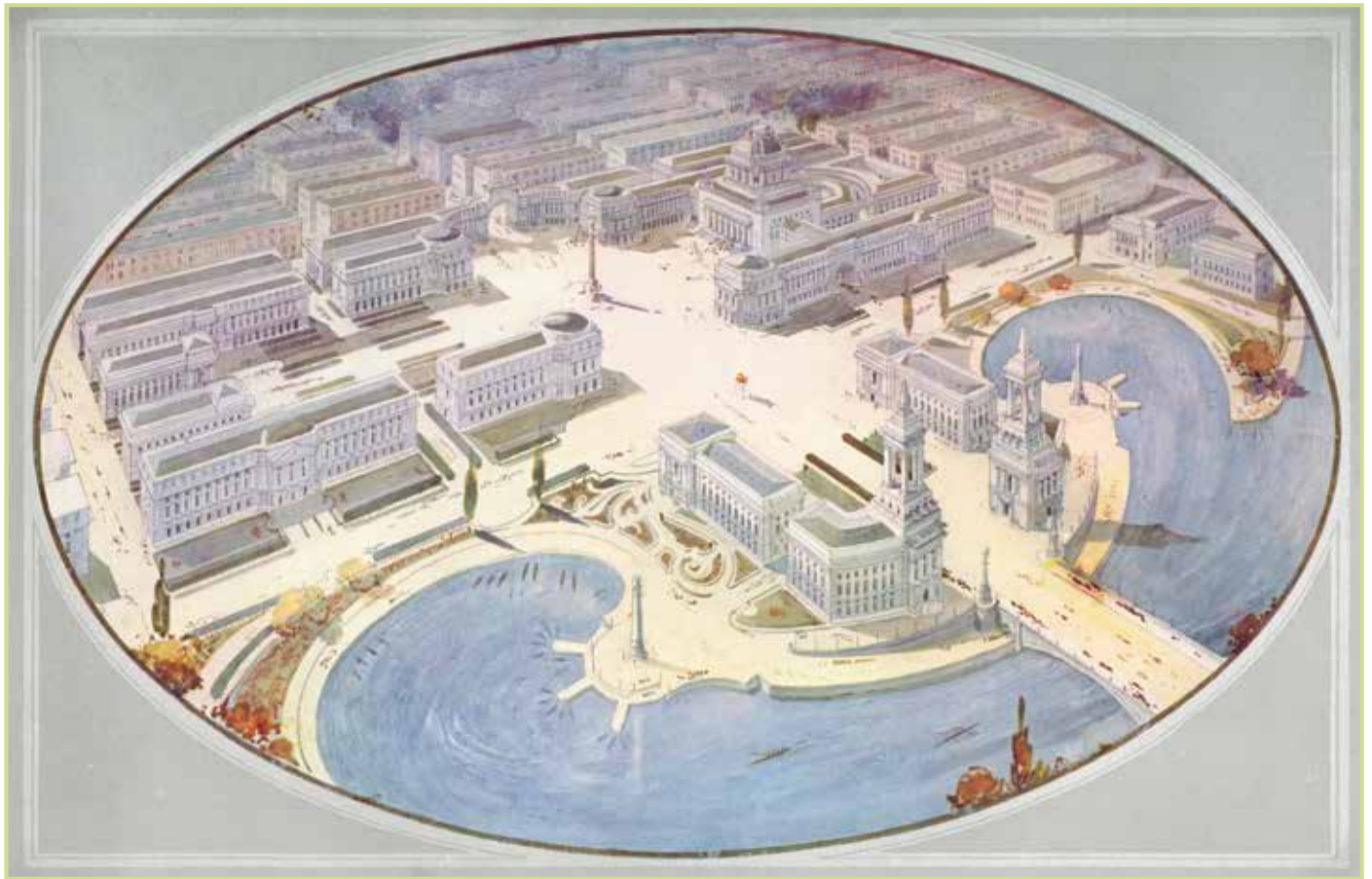
Calgary CEPEEAR Subdivision, currently Ogden.



# BIODIVERSITY

Land speculation and rapid development was a consistent theme throughout Calgary's early years. The city grew quickly, due in large part to settlement policies that encouraged immigration to settle and break the soil of the Prairie provinces. The discovery of oil in Turner Valley in 1914 added to the economic prosperity of Calgary.

As the Town of Calgary grew, beautification became a conscious endeavor. By 1895, municipal resources were dedicated to boulevard planting. Then, with the birth of the Parks department in 1910, more formalized efforts began to put a system of parks in place to promote public interest in parks and to cultivate knowledge in the care and value of parks.

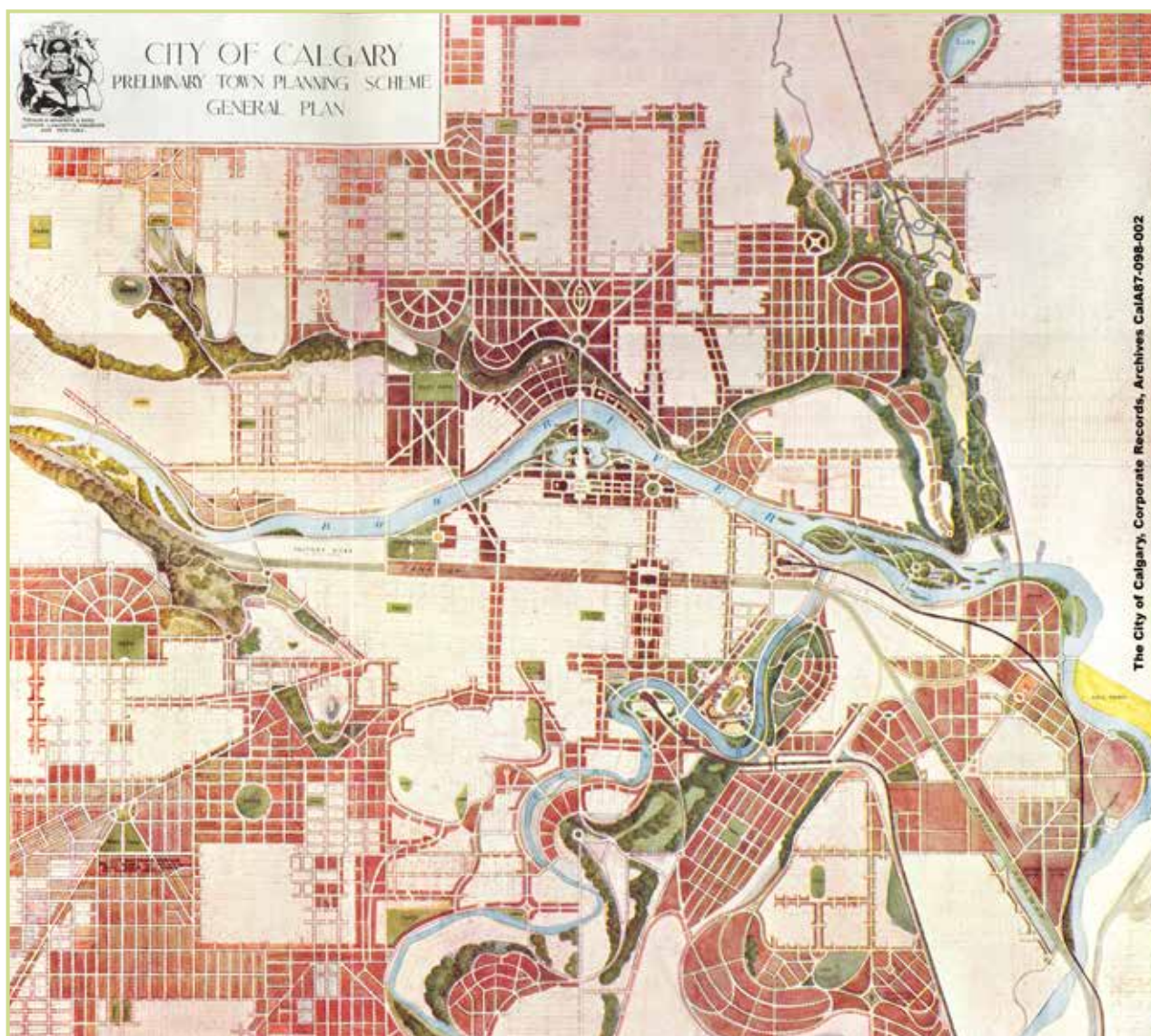


*The Civic Centre, The Mawson Plan (The City of Calgary, Corporate Records, Archives CalA87-098-001)*

# BIODIVERSITY

The City had long recognized the need to develop a contiguous open space system connected to key waterways, as well as significant escarpments. The impressive inventory of natural features, including vast expanses along the river valley and dramatic scenic bluffs, was noted in vision documents dating back to 1910 (William Pearce) and 1914 (the Mawson Plan). The City's General Plan of 1963 reiterated the inherent value of these natural landscape features. All three plans referenced the need to connect the parks and open spaces, to each other and to the people of Calgary, with a network of pathways and scenic boulevards. And while the motivations were largely recreation-based, implicitly this continued the structure needed for conservation of habitat and biodiversity today.

World War I, and then the Depression in 1929 put an end to much of the rapid growth and land speculation in Calgary, severely curtailing most urban growth until the end of World War II. Despite the economic hardship, the lull in growth provided an opportunity for The City to develop a strategy to manage a system of parks and pathways. In 1922, The City's administration adopted a policy for reserving lands for parks to align with the growth of new communities.



*The Mawson Plan, (The City of Calgary, Corporate Records, Archives CalA87-098-001)*



## URBAN GROWTH

The early European settlers had arrived intent on changing Calgary's natural setting from a perceived barren landscape to one that resembled the aesthetic of their homeland. But now Calgary was home to an entire generation that had developed a special appreciation for the region's natural landscapes.

At the end of World War II a renewed optimism and the discovery of significant oil reserves in the region led to increasing prosperity and growth for the city of Calgary. The baby boom spurred on urban growth, as did the desire for low-cost, single-detached housing for returning veterans. In 1968, Provincial planning legislation required that 10 per cent of land in new subdivisions be put aside as open space for recreational areas and school sites. During this period of explosive growth, The City's parks maintenance resources were stretched and it became more difficult to perpetuate the ornamental parks that Calgarians had become accustomed to. (see page 34 for an illustration of the growth of built form and municipal limits between 1951 and 2010 in Calgary.)

During the 1960s and 1970s, there was a growing recognition that Calgarians wanted and valued better parks for recreation, and that decorative gardens were becoming less desirable. In 1963, The City's General Plan referred to its inventory of natural features of river valleys and escarpments, and the inherent value in this natural landscape. One key component of this plan was to ensure the connectivity of parks, recognizing it as a system from both a natural and recreation perspective.

In the 1960s, community associations established themselves as the voice of the city's burgeoning residential neighbourhoods. Initially, this public collaboration may have been motivated by recreation, but it did set the groundwork for those who would become champions of our natural environment through advocacy for protection and beautification of their communities.

In 1929, a landowner donated 24 hectares along the west side of the Bow River to become a federal migratory bird sanctuary. It was the first natural area to be protected as a park in Calgary. Forty years later, the Calgary Field Naturalists' Society (formerly called the Calgary Bird Club) forged ahead with a newfound desire to preserve this natural environment through education. In 1970, The City purchased the area to become the Inglewood Bird Sanctuary, and established The City's first nature education program on the site.

In 1973, Council received a report on the inventory of flora and fauna in Calgary's natural areas, including recommendations on how to mitigate the effects of urban growth. This was another benchmark for The City to better understand Parks' role in protecting, enhancing and championing Calgary's natural environment.

Updating documents from the late 1970s, Parks developed the 1984 Calgary River Valleys Plan, which was a culmination of efforts going back 100 years to recognize the value of natural areas — not only along the riverbanks and escarpments, but also ensuring links to major parks and open spaces beyond the river valleys. It was this plan that established three typologies for park categories: undisturbed natural areas would limit human access and be intended to encourage enhancement of natural areas; naturalized parks were classified for rehabilitation and minimal maintenance requirements; manicured parks were intended for various types of recreation.

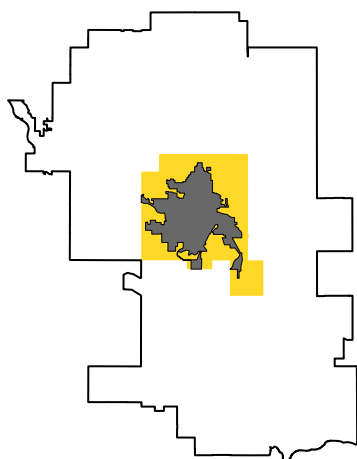
Other key historic influences include The City's Adopt-a-Park program established in 1985 to encourage individuals and groups to help maintain green spaces. Parks Foundation Calgary was a key supporter that helped co-ordinate volunteer initiatives and fundraising to promote education about Calgary's natural beauty, as well as to preserve ecologically significant areas.

# BIODIVERSITY

## CALGARY'S GROWTH 1951 – 2010

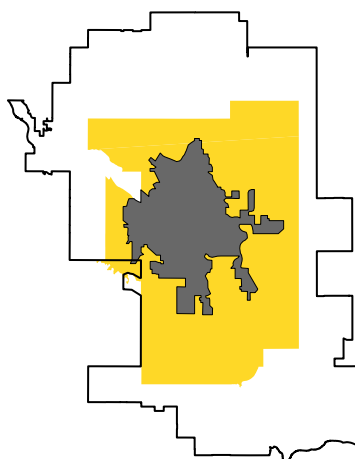
Calgary's spatial growth, built form and municipal limits, 1951 – 2010

1951



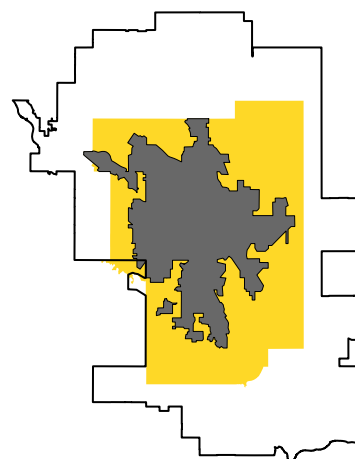
Built Form – 40 km<sup>2</sup> | City Limit – 104 km<sup>2</sup>

1961



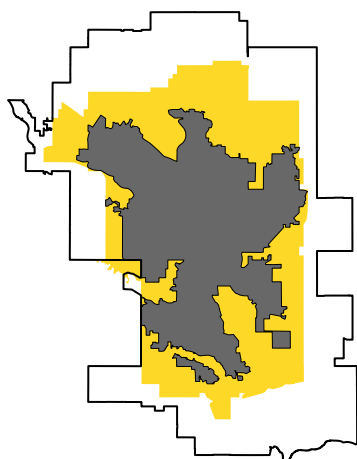
Built Form – 104 km<sup>2</sup> | City Limit – 394 km<sup>2</sup>

1971



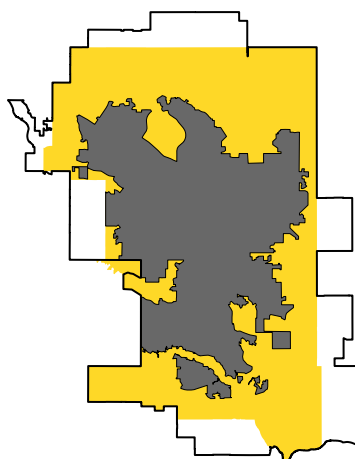
Built Form – 163 km<sup>2</sup> | City Limit – 404 km<sup>2</sup>

1981



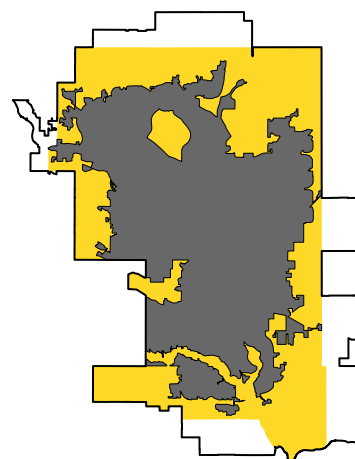
Built Form – 261 km<sup>2</sup> | City Limit – 509 km<sup>2</sup>

1991



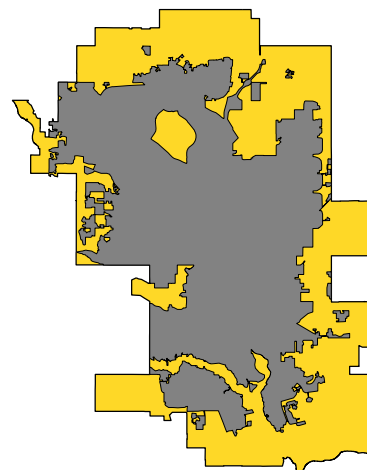
Built Form – 316 km<sup>2</sup> | City Limit – 703 km<sup>2</sup>

2001



Built Form – 400 km<sup>2</sup> | City Limit – 722 km<sup>2</sup>

2010



Built Form – 469 km<sup>2</sup> | City Limit – 848 km<sup>2</sup>

### Legend

- Extent of Built Form by Year
- Municipal Limits by Year
- Municipal Limits – 2010



In 1994, City Council approved the Natural Area Management Plan, a keystone document that built upon existing policy and set a clear priority on managing and protecting natural areas in the city for their own inherent value. Protection of biodiversity is a recurring theme in the Plan. One of the most significant policies within it establishes the protection of natural resources in Natural Environment Parks as a priority over other uses.

Three events in particular played a role shaping conservation in Calgary: the debate over development in and around the Glenmore Reservoir; a public push to protect the banks of the Bow River in the downtown core in the 1960s; and the public outcry against development of Nose Hill in the 1970s.

1. **Glenmore Reservoir:** In 1933, The City completed construction of the Glenmore Reservoir in a broad valley of the Elbow River located between the city limits and the Tsuu T'ina Nation. The valley was flooded to provide a stable, clean supply of drinking water, which had been a persistent issue since the founding of the city. Required for part of the project, the Weaselhead Flats of the Tsuu T'ina Nation reserve, became one of Calgary's most significant Natural Environment Parks.

Development around the reservoir was restricted as a measure to protect the water supply. As the city expanded south, and ultimately incorporated the reservoir into city limits, pressure to develop housing and recreation around the reservoir grew. This issue came to a head in the 1960s as residential subdivisions threatened to close in. Land immediately surrounding the reservoir was ultimately protected, although it was almost entirely encircled with residential development.

2. **The Bow River:** As Calgary grew into an urban centre, the automobile became an increasingly important mode of transportation, and plans were developed to modernize roadways into the downtown core. The city had grown to the south such that the centre of the city straddled the Canadian Pacific Railway. In 1963, the Canadian Pacific Railway approached The City with a proposal to move the railway one kilometre north – out of the core, to the banks of the Bow River, which was effectively the industrial backyard of the city. The City had planned a freeway system adjacent to the railway to alleviate automobile congestion issues into the core. The proposal initially had support from City Hall, but public opposition grew. Most of the opponents felt the river should be protected. The rail line was not relocated and the Bow River became the focal point of Calgary's urban park system.
3. **Nose Hill Park:** Protection of this park is a good example of where the initial preservation of natural habitats had more to do with circumstance than intent. Because of development restrictions that came from being in the approach path to Calgary's airport, this enormous stretch of real estate in the city's northwest had no development appeal early on, despite proper zoning and spectacular panoramic views. By 1969, modern air travel prompted changes to airport approach paths, effectively removing development restrictions from Nose Hill. What had been assumed to be a protected area now became prime development real estate. In 1970, the Calgary Field Naturalists' Society (now known as Nature Calgary) joined forces with 10 community associations to fight development. As a result of that effort, 1,129 hectares of grassland became a regional park in 1973, and remains one of North America's largest municipal parks. While the hill itself has been protected, urban development has encircled the area, thus restricting the ability to maintain wildlife corridors.

# BIODIVERSITY

## PRESENT-DAY INFLUENCES

There are many historic and current influences on Calgary's biodiversity. Recognizing and understanding the nature of these influences helps us understand how Calgary was shaped, both as a city and as an ecosystem.

## HABITAT DEGRADATION AND LOSS

A degraded or lost habitat is one that is altered in such a way that it is no longer able to support the species that are normally present. Disturbance often leads to replacement by non-native species, and typically, a consequent loss in species diversity. Habitat loss through agriculture, resource extraction, and increasingly, urban development, are seen as the largest challenge to biodiversity globally. The latter is the largest challenge in Calgary.

Habitats, however, are not always eliminated completely, particularly in urban environments. Pieces of the habitat can be incorporated into park space, may have been deemed undevelopable, or may simply have not been developed yet. The net result is typically islands where both plant and animal species are limited in their ability to move, leading to a loss of species and genetic isolation.

In addition, the changes in the surrounding landscape invariably bring alterations within the habitat itself (i.e. changes in site hydrology, soil compaction or loss, and the alteration or elimination of wildlife movement patterns). The net effect is a positive feedback process where the changes that result in lower biodiversity can exacerbate the problem. As these systems are altered and their ability to support species is reduced, they are replaced with species that can readily adapt to urban environments – many of which are considered to be invasive.

The impact can often be more far-reaching than a simple loss of species diversity. For example, the loss of wetlands significantly alters water cleaning and storage capacity in a watershed, which in turn impacts local human communities. The cumulative loss affects the resilience of other ecosystems to support species and withstand stress.

In Calgary, we can see how habitat loss and fragmentation have occurred over time. Important habitats, such as Nose Hill Park, have been encircled by development, greatly reducing connections to other habitats. As a result, some species are becoming less common. For example, sharp-tailed grouse have not been reported on Nose Hill in more than 15 years, and larger mammals, such as moose, are becoming increasingly rare.

See Rocky Ridge wetland (page 37) for an illustration of an altered landscape.

## INVASIVE SPECIES

International Union for the Conservation of Nature (IUCN) has identified invasive species as the second most significant challenge to biodiversity, after habitat loss. Large urban centres are susceptible to invasion as urban development and frequent human travel facilitate the dispersal of invasive species to disturbed and altered ecosystems, where they readily establish. Most invasive plant species in Calgary were introduced either accidentally, as ornamentals, or for food.

The fragmentation of native habitats in Calgary increases the spread of invasive species from surrounding transportation corridors, riverbanks, gardens, gravel pits and construction sites. Non-native invasive species can spread quickly because they lack predators and can out-compete native species for limited resources in these fragmented environments, thereby changing the species composition of the ecosystem.

Non-native species have also left all their biological controls behind – their pathogens, parasites and predators. The native species must contend with their own natural controls, while also trying to compete for sunlight, moisture and nutrients. The two major rivers running through the city act as ecological corridors further connecting sources of invasive species.



# BIODIVERSITY

## ROCKY RIDGE WETLAND LOSS

Rocky Ridge Predevelopment 1962



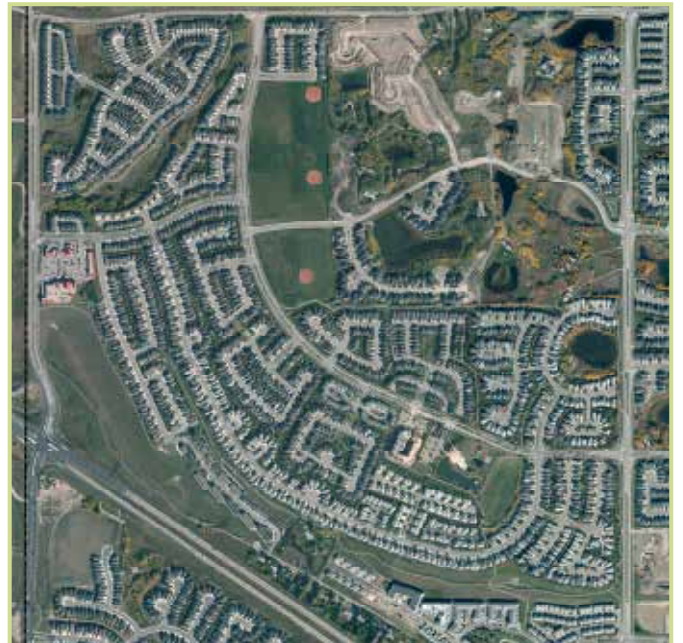
Rocky Ridge wetland loss 1997



Rocky Ridge wetland loss 2001



Rocky Ridge wetland loss 2010



# BIODIVERSITY

There are many invasive wildlife species in Calgary. House sparrow and European starling are abundant, and compete with native bird species for nest sites. Two or three introduced sport fish species have displaced and hybridized with native trout species (ARC 2004). More significantly, dams on the river have prevented native trout from migrating back up to their traditional spawning grounds, therefore affecting genetic dispersal. These dams have also changed natural hydrologic regimes, flows and temperatures with compounding affects to biodiversity.

## CLIMATE CHANGE

There is a clear link between broad, human-caused land use change, the production of greenhouse gases and climate change. This has been predicted to result in a warming global climate, thus altering the stability of weather patterns. As biodiversity can be, in part, a function of the local climate, climatic instability associated with rapid changes in weather patterns can drastically outpace species' ability to adapt to climate changes associated with global warming. Through this process global warming puts the viability of native populations at risk (IUCN).

Global warming affects biodiversity directly and indirectly. Even small changes in global temperature dramatically alter ecological systems. In colder climates, milder winters can result in increased survival of invasive species and disease-causing organisms; the recent expansion of the mountain pine beetle throughout British Columbia and now Alberta is one example of this. The pine beetle had normally been prevented from spreading into Alberta by sustained, cold winters. Along with drought and milder winters, this control has been eliminated, introducing a severe and widespread attack on pine forests.

An example of the relationship between altered land use patterns and climatic instability is evidenced by the changing location of animals and habitat. The mean rise in climatic temperatures and precipitation levels affects the distribution patterns of flora and fauna. These changes can be detrimental to the overall health, population sizes and location of some species as they fail to adjust to the movement of their habitat. For example, it's predicted we'll see a huge impact on alpine plant species just west of Calgary in the Rocky Mountains, as they don't have the option of moving north, but rather move upwards into alpine habitat that decreases in size and increases in fragmentation.

Among other things, climate change in Calgary is expected to bring increased growing seasons, along with changes in rainfall patterns and more frequent episodes of flooding and drought. It is quite likely that we may experience the arrival of new invasive species that are adapted to changed conditions. Riparian and aquatic invasive species such as flowering rush and salt cedar are two species that could respond to new conditions brought about by climate change.

Genetic diversity within species and populations can also be threatened by climate change. Individuals on the edge of a species' range are often the most important for adapting to climatic change, as they are better adapted to climatic extremes for that species. As change occurs, those individuals will be able to adapt or disperse more readily than others. Many species, but especially plants, respond more slowly to these changes as they are limited in the speed at which they can disperse.

As it relates specifically to western Canada, climate change modelling is predicting significant water shortages through a combination of shrinking glaciers and snow packs, increased evaporative losses, and increasing human consumption of the resource (Schindler and Donahue 2006). Changing water availability and patterns will have a direct causative effect on the region's biodiversity.



## EXTINCTION AND EXTIRPATION

Extinction is the loss of a species. Extirpation, or local extinction, is the disappearance of species from a region. Although these are both natural processes, human activities have been clearly linked to accelerated rates of extinction and extirpation beyond what would naturally occur.

Species loss is closely tied to habitat degradation and fragmentation, and is an indicator of environmental change. A good local example is the disappearance of the sharp-tailed grouse and the American badger within the city of Calgary. Although the badger does still persist in native prairie on the edge of the city, it has not been sighted recently within urban parks. The last confirmed sighting of sharp-tailed grouse in Nose Hill Park was in 1997.

Also of note, concurrent with European settlement, Plains bison were nearly eliminated from the North American prairies. Their extirpation from Calgary undoubtedly caused significant habitat changes in the region with the removal of grazing pressure, the introduction of agriculture and suppression of fire.

The greater prairie chicken spread into the Canadian Prairie provinces in the 1880s due to the availability of short-grass prairie habitat. Agricultural activities, development, fire suppression and invasive grass colonization from adjacent hay fields have all contributed to a substantial decline in short-grass prairie habitat, ultimately leading to their extirpation.

Although there is good information about rare and extinct animal species in the Calgary region, there is considerably less good evidence on the status of plants. Because specialised knowledge is required to identify many of the species, their status is updated much less frequently.

## EXTIRPATED PLANT SPECIES

Vascular plant species, bryophytes and lichens that have not been observed in the Calgary region since 2000.

Latin name	Common name
<b>Mosses and lichens</b>	
<i>Agrestia hispida</i>	Vagabond lichen
<i>Brachythecium reflexum</i>	Cedar moss
<i>Bryum algovicum</i>	
<i>Chaenotheca chrysocephala</i>	Stubble lichen
<i>Cyphelium notarisi</i>	Soot lichen
<i>Desmatodon heimii</i>	Long-stalked beardless moss
<i>Didymodon fallax</i>	Fallacious screw moss
<i>Drepanocladus brevifolius</i>	Brown moss
<i>Fissidens grandifrons</i>	Narrow-leaved Chinese phoenix moss
<i>Flavopunctelia soledica</i>	Powder-edged speckled greenshield lichen
<i>Fontinalis antipyretica</i>	Aquatic moss
<i>Grimmia donniana</i>	Donian grimmia
<i>Hygroamblystegium tenax</i>	
<i>Lepraria lobifrons</i>	Fluffy dust lichen
<i>Mnium ambiguum</i>	
<i>Orthotrichum affine</i>	
<i>Phascum cuspidatum</i>	Cuspidate earth moss
<i>Physcomitrium pyriforme</i>	Urn moss
<i>Physconia enteroxantha</i>	
<i>Pterygoneurum sessile</i>	
<i>Rhodobryum ontariense</i>	
<i>Schistidium pulvinatum</i>	
<i>Seligeria campylopoda</i>	
<i>Weissia controversa</i>	Green-cushioned weissia
<i>Xanthoria montana</i>	Sunburst lichen
<b>Vascular plants</b>	
<i>Lomatogonium rotatum</i>	Marsh felwort
<i>Pellaea glabella</i> ssp. <i>Simplex</i>	Smooth cliffbrake

## ECOSYSTEM SERVICES IN CALGARY

A healthy, functioning environment underpins a healthy economy and our own well-being. Nature provides numerous regulatory and economic services that are beneficial to us such as agricultural production, clean air and water, raw materials such as wood and textiles, and many medicines. Healthy ecosystems also regulate our climate, protect us from hazards such as flooding and extreme weather events, and offer opportunities for recreation, cultural fulfillment and spiritual renewal.

Many of these benefits, such as agriculture, are tangible and fairly well understood; however, some are less clear, such as the pollination provided by numerous species of insects and birds and their vital role in the health of our food systems. These services are often under-represented or absent in economic development decisions (Alberta Environment 2011).

Looking at nature as a conduit of ecosystem services helps communicate the social and economic values in our natural systems. This approach promotes the environmental benefits in decision making by providing a way to assist in better understanding and quantifying the value as a part of a balanced and thorough decision making process (TEEB 2010). But it's not without severe challenges. Putting a price tag on the inherent value of nature outside of the services it is understood to provide can be problematic. However, considering ecosystem services in policy making can be valuable by adding additional insight into municipal costing.

A recent Alberta Environment study of the ecosystem services provided by wetlands on the eastern edge of Calgary found that they provided numerous benefits to us, including a significant capacity to store water for wildlife and agriculture, to treat and clean water within our watershed, to provide significant recreational benefits, and to boost property values in adjacent subdivisions. A few quotes from the report highlight the various aspects of ecosystem services provided by local wetlands.

- The estimated total storage capacity lost due to wetland drainage between 1965 and 2011 is 9.2 million cubic metres. This represents a 20 per cent decrease in available water storage capacity in an area covering 274 square kilometres.
- The cost of replacing natural wetlands with built infrastructure was estimated at \$338 million.
- The estimated loss of soil organic carbon between 1962 and 2005 is equivalent to an emission of 161,832 tonnes of carbon dioxide. Applying the province's value of \$15/tonne of carbon dioxide equivalent, the economic value of carbon storage in the case study area would amount to \$16.7 million.
- There is a clear relationship between property value and distance/adjacency to wetlands. If a property is adjacent to a wetland, the value of a house increases by \$4,390 – \$5,136 (Alberta Environment 2011).

# GOVERNANCE OF BIODIVERSITY

## A BRIEF HISTORY OF BIODIVERSITY MANAGEMENT IN CALGARY

In 1914 the Mawson Plan was delivered to City Council. In it was a vision of a cosmopolitan urban environment with open spaces connected through urban corridors. The proposal, however, did not instil confidence in catering to business development and this, combined with the cost of implementing the plan and the onset of World War I, ultimately caused Council to reject the plan. If Council had adhered to the vision over the long term, Calgary would have had the basic urban structures that are of value from a biodiversity perspective, including ecological corridors and stepping stones of habitat.

Our changing perceptions of what constitutes quality open space in Calgary have been an ongoing dynamic. As the city became more of an established urban space in its own right – moving from a frontier land to a significant urban nexus – our understanding and appreciation for natural systems has grown. The following are a few highlights:

**William Reader:** Beginning in 1922, Parks' third superintendent began establishing his own garden at the City residence provided to him near Union Cemetery in what is now central Calgary. He experimented with seeds, plant species and overall planting locations to learn what fit best with the local climate. Throughout his tenure, William Reader promoted public access to the garden. Following his retirement in 1942, the park saw decades of neglect. In 2005, Parks completed a detailed landscape restoration of the site, and Reader Rock Gardens, a valued cultural landscape, was designated a Provincial Historic Resource.

**Urban Forestry:** In 1894, Calgary's municipal government was providing spruce trees at a subsidized fee to homeowners for beautification of boulevards and backyards. This was the beginning of urban forestry in Calgary. In 1988, Council approved the Urban Forestry Management Plan, establishing a target ratio of one tree for every two people in the city. This meant planting thousands of trees to keep up with population growth. In 2007, the Plan was updated to emphasize the need for public collaboration in maintaining the health of Calgary's trees and shrubs.

**Water management:** Council adopted The City of Calgary Parks Water Management Strategic Plan in 2007 with the implicit intent to keep Calgary's ecosystem healthy and sustainable by recognizing the relationship between beautiful gardens and water conservation.

**Legacy Parks:** In June 2003, dividends from City-owned ENMAX Energy Corporation went into an ENMAX Legacy Parks Program to acquire and develop parkland. The program was extended in 2007, with Council remaining committed to the program. The Haskayne family donated money to contribute to Haskayne Legacy Park on the east side of the Bearspaw Reservoir at the western limits of the city. Directly across the reservoir is Bearspaw Legacy Park, which is currently located outside of Calgary's municipal boundary.

## CALGARY'S TOOLS FOR CONSERVATION OF BIODIVERSITY

The City has developed a number of policies and tools that guide the conservation of biodiversity. Some of these are internal to The City, while others stem from provincial and federal authorities. Our approach to conserving biodiversity has been influenced by a strong history of conservation policy, dating back as far as the Mawson Plan in 1911, which advocated for the use of native plants that would survive Calgary's climate, while encouraging the experimentation of some foreign species to add to landscape variety.

In 1984, Council approved the Calgary River Valleys Plan, which established for the first time, policies and guidelines for active management of our natural areas. Following this other significant documents were produced, including the Urban Park Master Plan, the Nose Hill Park Master Plan and the Natural Area Management Plan. Collectively these documents provide broad direction for the protection and management of significant landscapes in Calgary.

# GOVERNANCE OF BIODIVERSITY

Like all municipalities in the province of Alberta, Calgary has powers that stem from the provincial *Municipal Government Act* (MGA). Generally speaking, municipalities are not directly empowered to regulate or protect the environment (Mallet 2005), but they do have broad powers to pass bylaws that can directly or indirectly affect the environment, and to regulate land use and development. The MGA provides specific land use planning powers (among other things), which are exercised through Council's passing of bylaws, resolutions and policies. The Province, along with the federal government, has broader, stronger powers that enable them to directly regulate environmental issues such as air and water quality, pollution, wildlife management and species at risk.

Land use planning and development can have a significant impact on our local environment. The municipality has the authority to regulate through policy and bylaw a process for orderly growth. Although the MGA does provide municipalities with some scope for enabling environmental protection, that scope is somewhat limited. Municipalities can dedicate 10 per cent of developable land in a subdivision as Municipal Reserve (MR) for purposes such as schools and parks; some of which can be used to protect natural environments.

Environmental Reserve (ER) can also be taken at the time of subdivision for any land considered undevelopable such as unstable slopes, wetlands, ravines, drainage courses or areas subject to flooding. Beyond MR and ER, there are comparatively few tools available to municipalities to protect environmentally sensitive lands.

Calgary's most recent Municipal Development Plan (MDP), adopted in 2009, incorporates principles of sustainability and long-term smart growth. This document outlines a series of clear environmental policies. Section 2.6, Greening the city, puts a priority on conserving and connecting ecosystems. One of the objectives is to "Maintain biodiversity and landscape diversity, integrating and connecting ecological networks throughout the city."

The following is a brief summary of statutory and non-statutory policies and guidelines that collectively guide Administration and Council to work towards the better protection of biodiversity.

## PARKS' PLANS AND POLICIES

### Calgary River Valleys Plan (1984)

The Calgary River Valleys Plan provides direction for the creation of a comprehensive open space system in Calgary's river and creek valleys. The principles rooted within this plan laid the foundations for the Urban Park Master Plan.

### The Urban Park Master Plan (1994)

The Urban Park Master Plan is The City's strategic plan for guiding the protection and conservation of our river valley parklands. One of the aims of this document is to balance the dual goals of preserving natural landscape features while providing a variety of accessible outdoor recreation opportunities. The study area includes key natural features within the city, such as the Bow River, the Elbow River, Nose Creek and West Nose Creek river valleys.

### The Natural Area Management Plan (1994)

This plan established a process for identifying and ensuring the long-term viability of Calgary's natural environments. It contains management guidelines and puts forward a landscape ecology approach to protecting and evaluating Calgary's natural systems.

### Integrated Pest Management (1998)

The City adopted a policy on Integrated Pest Management to promote healthy vegetation and to guide pest control activities on all public lands. It employs a combination of cultural, biological, mechanical and chemical means, as well as plant health care principles.



# GOVERNANCE OF BIODIVERSITY

## Open Space Plan (2003)

The Open Space Plan is the overarching policy document for Parks and sets out guidelines for acquisition and management of our parks, natural environments and urban forest through appropriate planning, design, management and education. The Plan outlines The City's intention to:

- Provide and maintain the integrity of a high-quality and diverse park and open space system.
- Protect and enhance the urban forest and natural environment areas.
- Provide environmental stewardship, education, programs and services.

## Calgary Wetland Conservation Plan (2004)

This plan was developed in response to concerns about the rate of wetland loss due to urban growth. The Plan has policies and procedures for the identification of wetlands and their associated environmental significance. It includes a "no net loss" policy and is one of the first municipal wetland policies in Canada.

## Parks Water Management Strategic Plan (2007)

This plan was adopted by Council to keep Calgary's ecosystem healthy and sustainable by recognizing the relationship between irrigation and water conservation.

## Environmental Reserve Setback Guidelines (2007)

These Council-adopted guidelines stemming from the *Municipal Government Act* of Alberta, established a greater setback from wetlands and water courses to prevent pollution discharge into water bodies, and to further protect riparian areas. There is a base setback that can be modified for factoring land quality and slope. Degraded lands and steeper slopes require a greater setback from water bodies.

## Parks Urban Forest Strategic Plan (2007)

The Urban Forest Strategic Plan is a non-statutory plan aligned with the Open Space Plan and the Parks Water Management Strategic Plan. Although the focus of the plan is the public urban forest, trees on private land are recognized to be an important part of the urban forest and many of the same principles and strategies apply. The ultimate goal of the urban forestry program is to achieve a sustainable urban forest.

## CORPORATE PLANS AND POLICIES

### imagineCALGARY (2006)

This document put forward the long-term 100-year vision for the city. It established goals for the protection of the natural environment system, as it relates to air, land and soil, plants and animals, and water. Targets were aligned with broad objectives to ensure appropriate evaluation criteria for clean air and water, and fertile soil. The vision imbues Calgary with a rich and intact ecosystem.

### Calgary Metropolitan Plan (2009)

The Calgary Metropolitan Plan reflects a shared regional responsibility for the protection, conservation and enhancement of our natural environment. Environmental protection occurs by directing significant growth away from sensitive natural areas identified within the plan.

### Municipal Development Plan (2009)

This city-wide policy gives direction to shape a more compact urban form and to "green" the city. The following are some of the Municipal Development Plan's high-level policies for the conservation, protection and restoration of our natural environment:

- Protect environmentally sensitive areas that conserve biodiversity and contribute to people's quality of life, communities and ecological systems.
- Create a more compact urban form that uses less land and, therefore, reduces habitat loss and fragmentation, as well as adverse impacts on wildlife, vegetation and water quality and quantity.
- Reduce Calgary's ecological footprint through various mechanisms.

# GOVERNANCE OF BIODIVERSITY

- Identify and protect strategic parcels, blocks and corridors that increase ecosystem connectivity.
- Integrate horizontal and vertical green infrastructure to maximize the provision of ecological services.

The Plan also contains broad objectives for the protection, conservation and enhancement of water quality and quantity through the creation of a land use and transportation framework that protects watersheds.

## **Calgary Transportation Plan (2009)**

The goals and policies of the Calgary Transportation Plan (CTP) are linked directly to the Municipal Development Plan (MDP). The design of a city's transportation system has a significant impact on urban form. Two stated goals of the CTP are to:

- Align transportation planning and infrastructure investment with city and regional land use directions and implementation strategies; and
- Advance environmental sustainability.

There are several transportation policies that work in conjunction with the MDP land use policies in support of the environmental sustainability goal, and one policy in particular specifies biodiversity (CTP s.3.12.c): "Preserve and enhance biodiversity to support the natural environment in and around mobility corridors".

## **City of Calgary Slope Adaptive Development Policy and Guidelines & Conservation Planning and Design Guidelines (2009)**

This non-statutory document provides direction to help ensure the type, distribution and densities of development are compatible with Calgary's natural terrain and the geologic character of sloped lands. The intent is to affect development in order to protect the aesthetic qualities of sloped lands and emphasize the visual quality of Calgary.

## **Bird-Friendly Urban Design Guidelines (2011)**

This non-statutory strategy-based document offers bird-friendly urban design strategies and guidelines for buildings and structures in Calgary's downtown core.

## **2020 Sustainability Direction (2011)**

The 2020 Sustainability Direction is a strategic guide that identifies steps The City must take over the next 10 years to achieve the imagineCALGARY 100-year vision. This document links long-range urban sustainability to short-term business plans and budgets, which act as reference points in moving to the 10-year horizon.

## **Area Structure and Area Redevelopment plans**

Area plans provide a framework for development in Calgary. They propose general land uses for a given area and provide The City direction for the protection and acquisition of open space for the conservation of our natural environment. General planning tools, consistent with Parks' Open Space Policy, establish techniques to develop communities that are responsive to our natural environment, and outline the legislative tools for land acquisition for these areas, as required.

## **A NATURAL AREA SYSTEMS APPROACH**

In 1994, The City of Calgary recognized the importance of protecting our habitat through a natural area systems approach to landscape ecology. As outlined in the Natural Area Management Plan, this framework aims to integrate natural areas into the urban fabric in a way that protects larger areas of natural lands. The Plan describes the approach as protecting vegetation communities, topography, soils, ecological associations and wildlife. Retaining the complexity of habitat types and their associated ecological relationships greatly increases the opportunity for long-term sustainability of the natural environment. This reduces the risk of habitat deterioration and species loss associated with small fragmented habitats, and also helps mitigate weed control, pest management and restoration costs.

# GOVERNANCE OF BIODIVERSITY

Ideally, a valuable natural system would include a diversity of vegetation communities, which in turn provides valuable wildlife habitat, have significant native character and provide wildlife movement corridors. Other important features would include habitat connectivity, especially beyond the city limits. When we recognize the need to have a connected ecosystem, we take a step toward developing a landscape that is better adapted for biodiversity management.

## CONSERVATION CHALLENGES

Traditional success in conservation is associated with protecting large tracts of wilderness and rural land. Early park development in the United States (where the first national park – Yellowstone National Park — was designated in 1872) and here in Canada, with the designation of Banff National Park in 1885, are prime examples of this traditional mindset. Both generated nationwide parks systems. Initially these parks were set aside for purely human-focused purposes (tourism, hunting preserves and other economic benefits). It was only in the latter half of the 20th century, as human populations began to grow significantly, that the notion of conserving our natural environment through establishing protected areas gained momentum (Dixon and Sherman 1990).

Initially, the motivation for designating areas often stemmed from the need or interest to protect rarity, rather than to protect functioning, diverse habitats in their own right. In recent decades there has been a growing understanding of the complexities of nature and our increasing influence over the global dynamics of climate and ecosystems, as well as our inability to fully control the outcomes of these impacts. Over 80 per cent of Canadians live in cities and it has become clear that good conservation planning must be good city planning. The International Union for Conservation of Nature has recognized that the conservation of biodiversity must be linked to human settlement if sustainability goals are to be met (IUCN 2004).

Sustained economic and population growth in Calgary has presented many challenges. The city's population has increased steadily, and with that growth comes a demand for more housing and transportation infrastructure. Residential development has tended to be single residential housing, which has led to significant expansion of the city's boundaries. Calgary is forecasted to grow by 1.3 million people over the next half century, potentially placing significant demands on both our built and natural infrastructure.

With growth comes a heightened necessity for conservation, which requires connecting economic, social and environmental variables in accounting and decision making processes. Urban expansion tends to encourage biodiversity loss through habitat fragmentation, destruction and the disruption of ecological processes. As a city expands out into lands not previously urbanized, much of these areas are lost and covered by buildings and asphalt. Recognizing, however, the valuable services provided by lands with intact ecological processes, such as healthy riparian areas that enhance water quality and mitigate floods, will help enable decision making processes to better factor conservation and integration with the natural environment.

Recognition and positive actions require awareness of what biodiversity is and how it is an urban issue. A 2012 Ipsos Reid citizen survey revealed that approximately 30 per cent of Calgarians define biodiversity as a "variety of plants and animals"; 30 per cent connected the term to ideas of green space and sustainability; and upwards of 40 per cent had definitions outside of nature or were completely unfamiliar with the term. This study showcased the need to connect urban growth with biodiversity.

# GOVERNANCE OF BIODIVERSITY

Taking direction from the International Union for Conservation of Nature, The City of Calgary must link biodiversity goals and human settlement patterns. Calgarians place an extremely high importance on the value of parks and their contribution to well-being, sense of community, identity and the future of Calgary. Demonstrating these values and how they connect to biodiversity, and how biodiversity can help advance them, will help foster civic awareness and encourage stewardship practices. This, collectively, along with advancing research and creating sound policies will ensure ecological processes are kept intact as Calgary grows.

## CURRENT CITY MANAGEMENT FOR BIODIVERSITY

Parks is the lead City business unit for conservation and management of public open space including natural environments, wetlands, riparian areas and manicured parks. Parks works with a number of business units to achieve similar goals of providing healthy, intact natural areas and open spaces.

Council has provided clear direction that encourages and supports conservation as a core value in The City. All business units play a role in sustainability and conservation of natural resources, along with Parks. Some of the key departments that play a role include:

### Transportation

Transportation business units play an active role in the conservation of biodiversity during planning, development and operation of the transportation system. Long range transportation planning studies are scoped to identify and address biophysical features and processes such as wildlife movement corridors and environmentally significant areas with the aim of avoiding or minimizing the loss of biodiversity

through careful route alignment and appropriate mitigation measures applied to design and construction. Environmental construction operations plans guide all work done on the major linear construction projects and facilities, and these plans include guidance on tree protection, aquatic habitat and water quality protection, as well as weed control. Throughout construction, and then during operation of the transportation system over the long term, identified noxious weeds (invasive species that undermine native species biodiversity, and are prone to spread on development sites and especially along rights-of-way) are monitored and controlled by means of mowing, pulling and herbicide application. The second largest threat to biodiversity globally, after habitat loss and fragmentation, is being addressed locally by this department through clear protocols and procedures.

### Utilities and Environmental Protection

The department of Utilities and Environmental Protection is tasked with environmental management through air quality and greenhouse gas monitoring, and policy development. The department also maintains the integrity of the water supply, ensures protection of riparian areas, and is responsible for the overall management of our urban watershed.

### Planning, Development and Assessment

Local Area Planning and Implementation within the Planning, Development and Assessment department provides services devoted to developing, recommending, promoting and implementing land use policies. The department is tasked with managing the development of the city, calling upon other business units such as Parks and Water Resources to provide technical expertise in land development decision making.



# GOVERNANCE OF BIODIVERSITY

## CONSERVATION SUCCESSES

The City recognizes both the effect of conservation practices and the importance of building a land stewardship ethic to help enable biodiversity protection and enhancement. By developing internal and external alliances and partnerships, The City has a broad network to support ecological health and landscape connectivity throughout our region. Through land protection and education programs we are implementing environmental conservation and land stewardship strategies. A sampling of these are highlighted below.

## PROGRAMS

### Parks ENMAX Legacy Fund

ENMAX is The City of Calgary's wholly-owned electrical utility subsidiary. In 2003, Calgary City Council created the ENMAX Legacy Fund for land acquisition and regional park development in future growth areas, as well as for acquisition and development of high-priority parks within the city. To date, funds from this program have been used to establish significant natural environment parks, including Ralph Klein Park, a major constructed wetland park in southeast Calgary, and Haskayne and Bearspaw parks, which together protect significant native prairie and riparian habitat in the Bow River Valley.

### Citizen Science Volunteer Program

Environmental & Education Initiatives (E&EI) is a portfolio within Parks that focuses on environmental education for the public. Citizens can become active environmental stewards by learning about their surroundings through first-hand experiences in the environment. This approach promotes the concept of biodiversity as a seamless component of all education programs and services offered.

Together with the Parks Natural Area Management team, a Citizen Science Volunteer Program was piloted in 2012. This program called upon volunteers to collect biodiversity data throughout Calgary with the goal to understand how to develop an effective data collection volunteer program. As a result, E&EI is broadening the program to include more volunteer opportunities, and simplifying the data collection process into "BioBlitz," a program designed for public and separate school boards to introduce biodiversity awareness and data collection to students.

### Wetland Compensation Bank program

In 2004, Calgary City Council approved the Calgary Wetland Conservation Plan, which set forth a policy of "no net loss" of wetlands to development. When a development results in an unavoidable loss of wetlands, the developer is required to pay a compensation amount to The City sufficient to protect and restore wetlands that will offset the loss. Funds paid into this program are being used to acquire and restore key wetland areas in Calgary's watersheds, as well as degraded habitats in the inner city. Laycock Park is the first compensation project under this program. (See Laycock Park wetland compensation on the following page for details about this project.)

## PARTNERSHIPS

### Adopt-a-Park

Adopt-a-Park is a year-round volunteer program that allows Calgarians to maintain and care for the green spaces, parks, flower beds or natural parks within their communities. This partnership helps hundreds of community groups and thousands of individuals beautify and green the city.

# GOVERNANCE OF BIODIVERSITY

## Parks Foundation Calgary

Parks Foundation Calgary is a non-profit, volunteer-based organization with a focus on preserving Calgary's heritage and natural beauty. They partner with other organizations to ensure that new parks and open spaces are developed in Calgary, and that ecologically significant river valleys are preserved. The Parks Foundation has partnered with The City of Calgary and other agencies to protect and develop major park projects throughout Calgary.

## PARK DEVELOPMENT

### Ralph Klein Park



Ralph Klein Park is Calgary's newest major park near the southeast edge of the city. It features a man-made wetland that uses natural vegetation to treat stormwater before it is discharged into the Bow River. Located within this 30-hectare park is the Environmental Education and Ethics Centre, offering numerous on-site environmental education programs.

### Laycock Park wetland compensation



Situated in the Nose Creek Valley, Laycock Park was identified as the first wetland compensation site in Calgary. Parks received funding in 2011 to begin implementing the plan to reconstruct wetlands. Currently, Parks is working with the provincial and federal governments to obtain the necessary regulatory approvals.

# GOVERNANCE OF BIODIVERSITY

## Haskayne and Bearspaw Legacy parks



Together, Haskayne and Bearspaw parks represent a major stretch of important habitat protected along the Bow River on the northwest edge of Calgary. Their location upstream of the Bearspaw Water Treatment plant (one of only two such treatment facilities for all of Calgary), improves water quality at the source. This translates into lower operational costs for the water treatment process. Both parks are in the planning stage and not yet open to the public. The vision for this park system is the provision of a pathway and an interpretive trail that will meander through the area, along with a variety of environmental education and low-impact recreational activities.

## CONCLUSION

Calgarians' perceptions of their natural environment have changed. From an agricultural and ranching centre in its incorporation in 1884 with a population of 428 to a metropolis of now over 1.1 million people, Calgarians have grown to recognize the value in protecting our natural heritage.

This biodiversity report builds upon The City's recognition of the connections between a healthy, functioning natural environment and our well-being as citizens of Calgary. Along with other participating cities of the ICLEI Local Action for Biodiversity (LAB) program, we have added to the set of biodiversity reports developed in this partnership.

By reviewing the history of Calgary's biodiversity planning and management we have developed a base framework to be used by the LAB project team to develop a document of best practices and examples for use by partner cities. This report has documented the current state of biodiversity and its management within Calgary.

We recognize that there are gaps in governance to be filled. (But before we can better understand how to allocate resources to protect and enhance biodiversity, we have begun to put processes in place to establish a base matrix of biodiversity to work from.) By linking open space planning with biodiversity management and implementation we can reach our desired goals.

# GOVERNANCE OF BIODIVERSITY

As Calgary grows, the challenge of conserving biodiversity in the region is sure to be ongoing. Much of what we need to do to be successful is within our control, but some things are outside of the practical limits of The City's jurisdiction. None of this is particularly unique to Calgary. Understanding our opportunities and constraints provides a good working framework within which to advance biodiversity conservation, both here at home, and in collaboration with other LAB-member cities.

Our next step in the biodiversity management process is to develop a 10-year biodiversity action plan in accordance with the LAB project. This plan will create the framework for on-the-ground biodiversity interventions in Calgary, including land protection measures, education and outreach. Our plan will contribute to the models of urban biodiversity management for an international audience of practitioners, governments and interested citizens. This will help ensure our alignment to meet the objectives of the Convention on Biological Diversity: one, the conservation of biological diversity; two, the sustainable use of the components of biological diversity; and three, the fair and equitable sharing of the benefits arising out of the use of genetic resources.

The state of the environment is important to Calgarians and Canadians in general. The natural environment, our relationship with it – and its relationship with us – is a significant factor in how we measure our quality of life, our personal health and economic well-being. Recognizing this mutual relationship lies at the foundation of this report and will guide future policies in biodiversity management.



# GLOSSARY

**Amphibian:** Vertebrate animals including frogs, toads, newts and salamanders. They spend at least part of their lives both on land and in water. They are unable to regulate their body temperature and have smooth, air permeable skin.

**Anthropogenic:** Habitats that are created or influenced by sustained human activities. These can include dense urban areas, or areas that have had significant disturbance due to activities such as clearing and filling, agriculture or sustained use. Anthropogenic impacts typically result in loss of species diversity, and open up areas to invasion by non-native species.

**Biodiversity:** The City has adopted the same definition of biodiversity that is used within the international Convention on Biological Diversity and the Canadian Biodiversity Strategy: "...the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. [Biodiversity] includes diversity within species, between species and of ecosystems" (Hobson *et al.* 2008).

**Ecosystem:** A community of organisms and their physical environment.

**Endemic:** Species that are restricted to a particular locality or region.

**Extinction:** The end of an species or population, generally considered to occur when the last known member of a species dies.

**Extirpation:** The local extinction of species from a given area.

**Floodplain:** The land located immediately adjacent to the floodway which is not needed for the course or the conveyance of the designated flood, but which is, nonetheless, subject to inundation.

**Flyway:** A flight path used in bird migration. Calgary is located on two major North American flyways – the Pacific and the Central flyways.

**Forb:** Any herbaceous plant other than grasses or grass-like plants.

**Fragmentation:** To separate or divide naturally occurring habitats or plant communities.

**Fungi:** A group of organisms that include micro-organisms such as yeasts and moulds as well as mushrooms. They are more closely related to animals than plants and are characterised by the ability to break down nutrients in their external environment.

**Green space:** Open spaces that are generally not extensively developed which can include parks, gardens and habitats, and offer some ecological value.

**Habitat:** A grouping of vegetation communities, irrespective of ownership; or a place where an organism lives.

**Indigenous:** Any species that originates or occurs in a particular place.

**Invasive species:** Any non-native species that tends to spread prolifically.

**Lichen:** A group of composite organisms made up of a symbiotic relationship between a fungus and a photosynthetic partner (usually an algae).

**Monocot:** One of two major groups of flowering plants that include grasses, lilies and orchids. They are characterized by parallel leaf veins.

**Montane:** A Natural Subregion in Alberta that occurs in the lower slopes of valley bottoms of the major rivers in the Rocky Mountain foothills, including the Bow River Valley. Montane regions are characterized by relatively cool summers, warm winters and highly variable microclimates.

# GLOSSARY

**Native:** Species of animals or plants that have not been introduced by people or their direct activities. They are generally seen to have evolved or migrated to a given region without human influence.

**Natural Region:** The largest mapped unit in Alberta's ecological classification system. The units are defined on the basis of physical features such as climate, geology and soils, and biological features such as vegetation communities.

**Natural Environment Park:** For the purposes of this report, a Natural Environment Park is a City-owned park where the primary role is the protection of an undisturbed or relatively undisturbed area of land or water, or both, and has existing characteristics of a natural/native plant or animal community and/or portions of a natural ecological and geographic system. Examples include wetlands, escarpments, riparian corridors, natural grasslands and woodlots. Note: A relatively undisturbed Natural Environment Park would either retain or have re-established a natural character, although it need not be completely undisturbed.

**Natural Subregion:** A subset of Natural Regions further refined by biogeoclimatic factors.

**Non-vascular plants:** Mosses and related plants (liverworts and hornworts). They are characterized by a lack of water-conducting tissues and therefore absorb water and moist air directly through their leaves and stems. They do not produce flowers, fruits or seeds.

**Parasite:** Any organism that lives on or in another and gains its nutrients at the expense of its host.

**Perennial:** Any plant that lives for more than two years.

**Raptor:** A predatory bird (e.g. hawks, falcons, eagles and owls).

**Riparian:** The water's edge or zone between the aquatic and upland ecosystem.

**Sucker:** A form of vegetative reproduction by which a shoot is produced from the roots of a plant, producing a clone.

**Ungulate:** A hoofed mammal.

**Vascular plants:** A large group of plants that are characterized by having specialized tissue for conducting water and nutrients. Vascular plants include the club mosses, ferns and horsetails, conifers and flowering plants.

## ACRONYMS

AIPC – Alberta Invasive Plants Council

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

CTP – Calgary Transportation Plan

ESRD – Alberta Environment and Sustainable Resource Development

FWMIS – Fisheries and Wildlife Management Information System

IUCN – International Union for the Conservation of Nature

MDP – Municipal Development Plan

MGA – Municipal Government Act

SARA – Species at Risk Act

TEEB – The Economics of Ecosystems & Biodiversity

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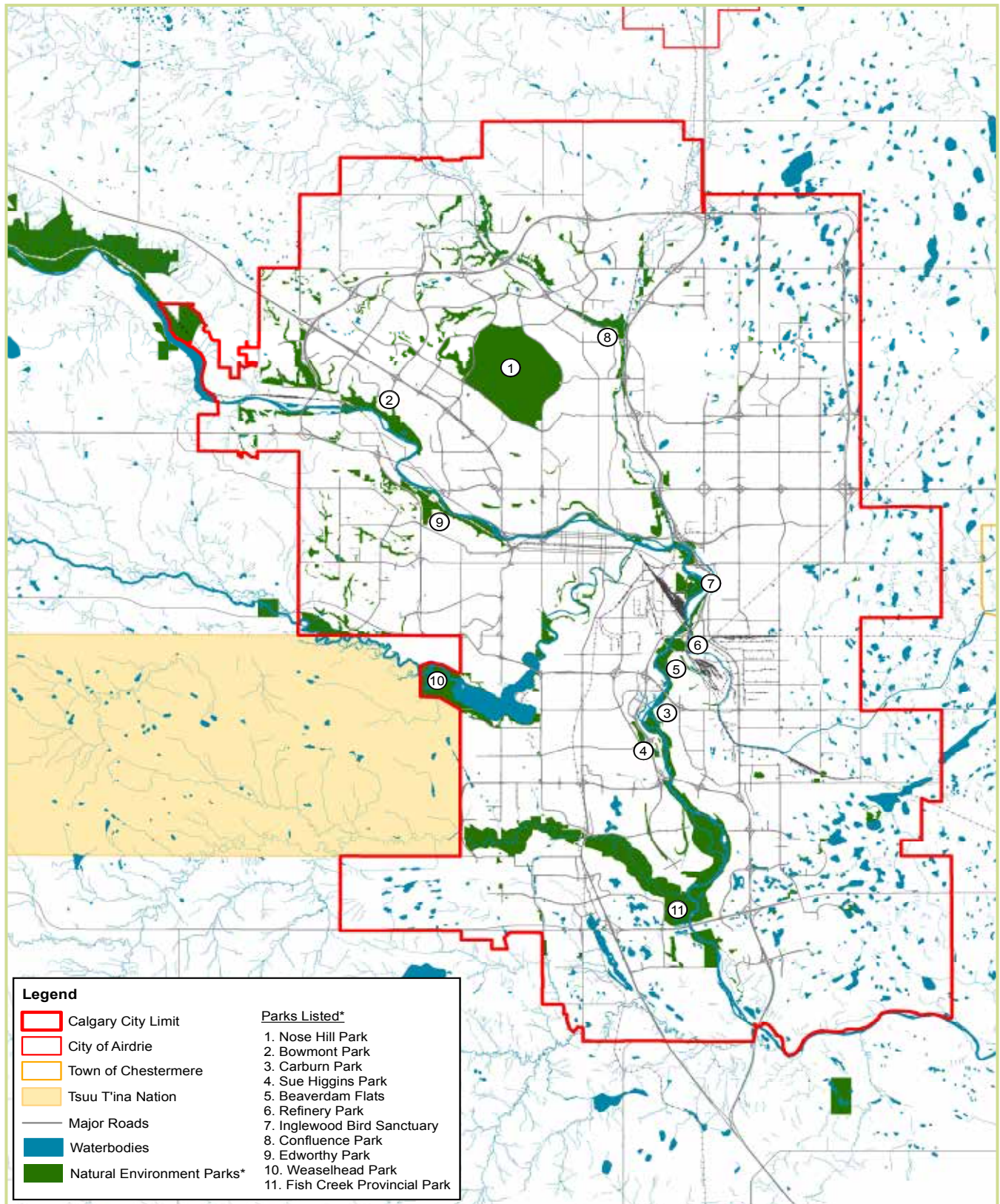
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# APPENDIX 1

## CALGARY'S MAJOR NATURAL ENVIRONMENT PARKS

There are many natural areas in Calgary, representing a diversity of habitats. The more prominent Natural Environment Parks are identified on the following map and featured in this section.



# APPENDIX 1

## 1. NOSE HILL PARK



Nose Hill Park lies in the northwest part of the city, surrounded by 12 residential communities. The park was created in 1980 and covers more than 1,129 hectares. It protects a significant rough fescue prairie within the city, one of the most threatened ecosystems in the Canadian prairies. The plateau is dominated by agronomic grasses, which have gradually encroached upon the less-disturbed slopes, threatening the integrity of these grasslands.

Sheltered areas and the cooler, wetter, north-facing slopes are typically dominated by aspen parkland and shrub communities. These areas provide important cover for a variety of wildlife species. This has become increasingly important as the park is now completely encircled by residential development, and traditional wildlife movement routes have been largely cut off. However, as they are adapted to an urban environment, large mammals such as deer and coyotes can be seen roaming the grasslands and coulees.

The park is home to porcupines, northern pocket gophers and several species of mice and voles. These smaller mammals are the main prey for the northern harriers and Swainson's hawks, which are often seen in the skies above the park.

## 2. BOWMONT PARK



Bowmont Park was founded in the early 1980s. It is a 164-hectare parcel that lies along the north shore of the Bow River containing a mix of native grassland in the upper slopes, and riparian balsam poplar forest in the floodplains. The park is deeply incised by ravines with several islands in the Bow River that are important habitat and refuge for some species.

Springs are a unique feature of Bowmont Park. Waterfall Valley is fed by a large spring that flows year-round. There are extensive tufa (calcium carbonate) deposits around the springs supporting unique plants that are dependent upon a year-round supply of water.

The riparian forest along the floodplain of the Bow River is a threatened ecosystem dependent on a seasonal flooding disturbance regime, which has been largely eliminated through flood control, irrigation and hydroelectric development in the South Saskatchewan River Basin.



## 3. CARBURN PARK



Carburn Park lies along the eastern shore of the Bow River in the city's southeast. The area was mined for gravel until the early 1980s when it was reclaimed as a park. The park offers a good example of a riparian deciduous forest and a significant shrubland community. The park's significant deciduous forest contains balsam poplar trees and many shrubs including Saskatoon, chokecherry and Canada buffalo berry.

Three ponds at Carburn Park contain fish that attract a number of species of fish-eating birds, including belted kingfishers and great blue herons. In the main river channel, diving ducks such as common goldeneye and buffleheads are often sighted.

Carburn Park is joined by Beaverdam Flats and Refinery Park on the eastern shores of the Bow River and is across the river from Sue Higgins Park, located on the west side of the river. All of these parks have similar riparian habitat. In Beaverdam Flats and Sue Higgins Park, backwaters and wetlands are also present.

## 4, 5, 6. BOW RIVER PARKS, SOUTH CALGARY



As the Bow River flows south and east, riparian zones are wider spread on old riverbeds. Major riparian parks along the southern reach of the river include Carburn Park, Sue Higgins Park, Beaverdam Flats, Refinery Park and the Inglewood Bird Sanctuary.

The waters of the Bow River are home to species such as Canada geese, common mergansers and several species of gulls. This river corridor is an important migratory route for many species of warblers and vireos with trees and shrubs providing important cover, and has ample evidence of the presence of beavers. Many of the larger still-standing trees have been wrapped with wire to protect them from beaver damage. Beaver lodges are often visible on the banks of both the Bow and Elbow rivers. Although somewhat more elusive, boreal chorus frogs and tiger salamanders have been observed in the inland ponds.

# APPENDIX 1

## 7. INGLEWOOD BIRD SANCTUARY



The Inglewood Bird Sanctuary was designated in 1929 as one of the now 92 Federal Bird Sanctuaries in Canada. Calgary has grown up and around the sanctuary, but even so, Inglewood Bird Sanctuary remains an important oasis for wildlife in the inner city with over 270 birds that have been recorded here. It is one of three municipally designated Special Protection Natural Environment Parks. It includes a visitor centre and offers many nature education and school programs.

The nature reserve covers 36 hectares of land along the west side of the Bow River. The riparian environment, including backwater lagoons is habitat for a variety of migratory as well as breeding birds, and a variety of wildlife including several resident deer and beavers.

## 8. CONFLUENCE PARK

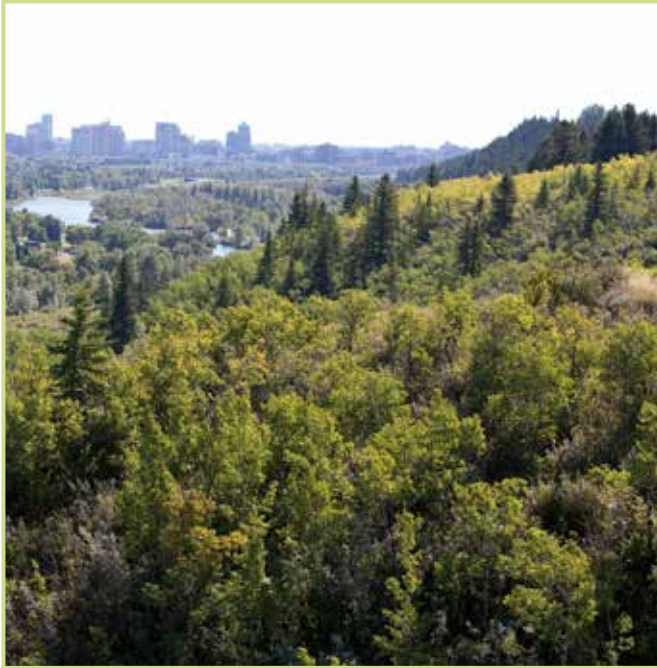


Confluence Park lies along both banks of West Nose Creek, near its confluence with Nose Creek in the northeast part of the city. The park was created in the early 1990s and occupies approximately 73 hectares.

West Nose Creek meanders through a large valley that has a considerable amount of native grassland and shrubland habitat. Much of the valley floor, and uplands were native rough fescue prairie, but have been invaded by brome and other agronomic grasses. The remainder of the valley floor is a rich riparian zone with several species of willows growing along the banks. Along the north-facing valley slopes there is an extensive shrub community composed of Saskatoon, northern gooseberry, silverberry and red-osier dogwood. Nose Creek has similar habitat, but has been channelized as the city developed around it. It no longer has the typical meanders that a creek its size would normally have. Some of the bird species found in these habitats include several species of waterfowl, swallows and birds of prey, such as northern harriers.



## 9. EDWORTHY PARK



Bordered by the Bow River and the communities of Wildwood and Spruce Cliff, Edworthy Park is a large and diverse park. It includes the natural areas of Douglas Fir Trail and Lawrey Gardens. In the early days, Lawrey Gardens was the site of a market garden in the floodplain of the Bow River. It was abandoned in the 1950s due to continual flooding and ice jams. Portions of the site were used as a rubble dump but eventually reclaimed as parkland in the 1990s. Today, the park covers about 169 hectares.

A unique characteristic of the park is the presence of Douglas fir, a conifer normally found west of the Rocky Mountains. Here, this species is restricted to the cool, moist north-facing slopes of the park and is one of the eastern most stands of Douglas fir in Canada. The park has a diverse mix of prairie and riverine habitats that is unique in the city. The forest is home to the birds and mammals more commonly found in boreal and foothills communities such as least chipmunks and red squirrels. It is also home to seed-eating birds like the red and white-winged crossbills, as well as ruby-crowned and golden-crowned kinglets.

The Douglas Fir Trail runs along a densely wooded escarpment with dramatic views of the Bow River Valley. The escarpment is 200 feet high and very steep, and like much of the Bow River escarpment, it is naturally unstable.

Wetlands at the base of the escarpment are frequented by a variety of birds including warblers, vireos, and catbirds. In and around these ponds are boreal chorus frogs, wood frogs and two species of garter snakes: wandering and red-sided.

## 10. WEASELHEAD PARK



The Weaselhead was acquired from the T'suu T'ina Nation for a reservoir and is named after Chief Weaselhead. The park is on the edge of the Glenmore Reservoir, which was built on the Elbow River in the 1930s to supply Calgary with drinking water. The park itself was created in the early 1980s and occupies approximately 237 hectares.

# APPENDIX 1

Notwithstanding the disturbance that came with flooding and tank training during its tenure as a military base, this park is home to a diverse array of species that are unusual for the Calgary region. The area is dominated by white spruce and trembling aspen, in addition to the riparian area of willow, tall shrub and some balsam poplar. At the mouth of the Elbow, as the river flows into the Glenmore Reservoir, is a large delta of wetland habitat. The delta is host to a relatively unique diversity of plants and animals. Weaselhead Park contains one of the largest stands of coniferous forest in the city.

The diverse habitats in Weaselhead Park allow for an equally varied community of birds and other wildlife. Numerous waterfowl are found in the area, including migratory species such as loons and tundra swans. The mud and sandbars of the delta provide habitat for shorebirds such as lesser yellowlegs and American avocet that feed upon aquatic insects in the rich shore deposits. The coniferous forest is home to both red and white-winged crossbills and the area's proximity to the countryside provides the best opportunity to see black bears within the city.

## 11. FISH CREEK PROVINCIAL PARK



Another major park within Calgary is Fish Creek Provincial Park located along Fish Creek, which flows west to east in south Calgary. At over 1,300 hectares, it is one of the largest urban parks in North America. It protects a diverse mix of aspen parkland, spruce forest and riparian balsam poplar habitat along Fish Creek and the Bow River. This park is managed by the Government of Alberta.

# APPENDIX 2

## CALGARY'S WILDLIFE AND PLANT BIODIVERSITY

### BIRDS

**Total species:** 365

**Total Sensitive/May Be At Risk/At Risk species:** 71

**Total Accident/Vagrant species:** 70

**Total Exotic species:** 8

- ▲ Indicates Provincial listing as Sensitive
- ▼ Indicates Provincial listing as May Be At Risk
- Indicates Provincial listing as At Risk
- ◆ Indicates Accident/Vagrant
- \* Indicates Exotic species

#### Auks (Alcidae)

Ancient murrelet◆

#### Accentors (Prunellidae)

Siberian accentor◆

#### Barn owls (Tytonidae)

Barn owl◆

#### Blackbirds, orioles and allies (Icteridae)

Baltimore oriole▲  
Bobolink▲  
Brewer's blackbird  
Brown-headed cowbird  
Bullock's oriole◆  
Common grackle  
Red-winged blackbird  
Rusty blackbird▲  
Western meadowlark  
Yellow-headed blackbird

#### Cardinals and allies (Cardinalidae)

Black-headed grosbeak  
Indigo bunting◆  
Lazuli bunting  
Northern cardinal◆  
Rose-breasted grosbeak

#### Chickadees and titmice (Paridae)

Black-capped chickadee  
Boreal chickadee  
Mountain chickadee

#### Cormorants (Phalacrocoracidae)

Double-crested Cormorants

#### Cranes (Gruidae)

Sandhill crane■  
Whooping crane■◆

#### Creepers (Certhiidae)

Brown creeper▲

#### Crows and jays (Corvidae)

American crow  
Black-billed magpie  
Blue jay  
Clark's nutcracker▲  
Common raven  
Gray jay  
Steller's jay

#### Cuckoos, roadrunners and anis (Cuculidae)

Black-billed cuckoo◆  
Yellow-billed cuckoo

#### Dippers (Cinclidae)

American dipper

#### Ducks, geese and swans (Anatidae)

American black duck◆  
American wigeon  
Barrow's goldeneye  
Black scoter◆  
Blue-winged teal  
Brant◆  
Bufflehead  
Canada goose  
Canvasback  
Cinnamon teal  
Common goldeneye  
Common merganser  
Eurasian wigeon  
Gadwall  
Garganey◆  
Greater scaup  
Greater white-fronted goose  
Green-winged teal▲  
Harlequin duck▲

# APPENDIX 2

## Ducks, geese and swans (Anatidae) continued

Hooded merganser  
King eider◆  
Lesser scaup▲  
Long-tailed duck  
Mallard  
Northern pintail▲  
Northern shoveler  
Red-breasted merganser  
Redhead  
Ring-necked duck  
Ross's goose  
Ruddy duck  
Snow goose  
Surf scoter  
Trumpeter swan■  
Tufted duck◆  
Tundra swan  
White-winged scoter▲  
Wood duck

## Falcons and caracaras (Falconidae)

American kestrel▲  
Gyr Falcon  
Merlin  
Peregrine falcon■  
Prairie falcon▲

## Finches and allies (Fringillidae)

American goldfinch  
Cassin's finch  
Common redpoll  
Evening grosbeak  
Gray-crowned rosy-finch  
Hoary redpoll  
House finch  
Pine grosbeak  
Pine siskin  
Purple finch  
Red crossbill  
White-winged crossbill

## Grebes (Podicipedidae)

Clark's grebe▼  
Eared grebe  
Horned grebe▲  
Red-necked grebe  
Pied-billed grebe▲  
Western grebe▲

## Grouse, turkeys and allies (Phasianidae)

Blue grouse  
Chukar\*  
Gray partridge\*  
Ring-necked pheasant\*  
Ruffed grouse  
Sharp-tailed grouse▲  
Spruce grouse  
White-tailed ptarmigan  
Wild turkey\*

## Gulls, terns and allies (Laridae)

Arctic tern◆  
Black tern▲  
Black-legged kittiwake◆  
Bonaparte's gull  
California gull  
Caspian tern▲  
Common tern  
Forster's tern▲  
Franklin's gull  
Glaucous gull  
Glaucous-winged gull◆  
Herring gull  
Iceland gull  
Lesser black-backed gull◆  
Little gull◆  
Long-tailed jaeger◆  
Mew gull  
Parasitic jaeger◆  
Pomarine jaeger◆  
Ring-billed gull  
Sabine's gull  
Slaty-backed gull◆  
Thayer's gull



## Hawks and allies (Accipitridae)

Bald eagle▲  
 Broad-winged hawk▲  
 Cooper's hawk  
 Golden eagle▲  
 Northern goshawk▲  
 Northern harrier▲  
 Osprey▲  
 Red-tailed hawk  
 Rough-legged hawk  
 Sharp-shinned hawk  
 Swainson's hawk▲

## Hérons, egrets and bitterns (Ardeidae)

American bittern▲  
 Black-crowned night-heron▲  
 Cattle egret◆  
 Great blue heron▲  
 Great egret◆  
 Green heron◆  
 Snowy egret◆  
 Yellow-crowned night-heron◆

## Hummingbirds (Trochilidae)

Anna's hummingbird◆  
 Black-chinned hummingbird◆  
 Calliope hummingbird  
 Ruby-throated hummingbird  
 Rufous hummingbird

## Ibises and spoonbills (Threskiornithidae)

White-faced ibis▲

## Kingfishers (Alcedinidae)

Belted kingfisher

## Kinglets (Regulidae)

Golden-crowned kinglet  
 Ruby-crowned kinglet

## Larks (Alaudidae)

Horned lark

## Loons (Gaviidae)

Common loon  
 Pacific loon  
 Red-throated loon  
 Yellow-billed loon◆

## Mockingbirds and thrashers (Mimidae)

Brown thrasher  
 Gray catbird  
 Northern mockingbird◆  
 Sage thrasher◆

## New world sparrows (Emberizidae)

American tree sparrow  
 Baird's sparrow▲  
 Brewer's sparrow▲  
 Chestnut-collared longspur▲  
 Chipping sparrow  
 Clay-colored sparrow  
 Dark-eyed junco  
 Field sparrow◆  
 Fox sparrow  
 Golden-crowned sparrow◆  
 Grasshopper sparrow▲  
 Green-tailed towhee◆  
 Harris's sparrow  
 Lapland longspur  
 Lark bunting  
 Lark sparrow  
 Le Conte's sparrow  
 Lincoln's sparrow  
 McCown's longspur  
 Nelson's sharp-tailed sparrow  
 Savannah sparrow  
 Smith's longspur◆  
 Snow bunting  
 Song sparrow  
 Spotted towhee  
 Swamp sparrow  
 Vesper sparrow  
 White-crowned sparrow  
 White-throated sparrow

## New world vultures (Cathartidae)

Turkey vulture

## Nighthawks and nightjars (Caprimulgidae)

Common nighthawk▲  
 Common poorwill◆

# APPENDIX 2

## Old world sparrows (Passeridae)

House sparrow\*

## Old world warblers and gnatcatchers (Sylviidae)

Blue-gray gnatcatcher◆

## Pelicans (Pelecanidae)

American white pelican▲

## Pigeons and doves (Columbidae)

Band-tailed pigeon◆

Eurasian collared-dove\*

Mourning dove

Rock dove\*

## Plovers and lapwings (Charadriidae)

American golden-plover

Black-bellied plover

Killdeer

Pacific golden-plover◆

Piping plover■

Semipalmated plover

## Rails, gallinules and coots (Rallidae)

American coot

Sora▲

Virginia rail

Yellow rail

## Sandpipers, phalaropes and allies (Scolopacidae)

Baird's sandpiper

Black turnstone◆

Buff-breasted sandpiper

Curlew sandpiper◆

Dunlin

Greater yellowlegs

Hudsonian godwit

Least sandpiper

Lesser yellowlegs

Long-billed curlew▲

Long-billed dowitcher

Marbled godwit

Pectoral sandpiper

Red knot▼

Red phalarope

Red-necked phalarope

Red-necked stint◆

Ruddy turnstone

Ruff◆

Sanderling

## Sandpipers, phalaropes and allies

(Scolopacidae) **continued**

Semipalmated sandpiper

Sharp-tailed sandpiper◆

Short-billed dowitcher

Solitary sandpiper

Spoonbill sandpiper◆

Spotted redshank◆

Spotted sandpiper

Stilt sandpiper

Upland sandpiper▲

Wandering tattler◆

Western sandpiper

Whimbrel

White-rumped sandpiper

Willet

Wilson's phalarope

Wilson's snipe

## Shrikes (Laniidae)

Loggerhead shrike▲

Northern shrike

## Starlings and mynas (Sturnidae)

European starling\*

## Stilts and avocets (Recurvirostridae)

American avocet

Black-necked stilt▲

## Swallows and martins (Hirundinidae)

Bank swallow

Barn swallow▲

Cliff swallow

Northern rough-winged swallow

Purple martin▲

Tree swallow

Violet-green swallow

## Swifts (Apodidae)

Black swift

Vaux's swift◆

White-throated swift◆

## Tanagers (Thraupidae)

Scarlet tanager◆

Summer tanager◆

Western tanager▲

## Thrushes (Turdidae)

American robin  
 Eastern bluebird◆  
 Gray-cheeked thrush  
 Hermit thrush  
 Mountain bluebird  
 Northern wheatear  
 Swainson's thrush  
 Townsend's solitaire  
 Varied thrush  
 Veery  
 Western bluebird◆

## Typical owls (Strigidae)

Barred owl▲  
 Boreal owl  
 Great gray owl▲  
 Great horned owl  
 Long-eared owl  
 Northern hawk owl  
 Northern pygmy-owl▲  
 Northern saw-whet owl  
 Short-eared owl▼  
 Snowy owl

## Tyrant flycatchers (Tyrannidae)

Alder flycatcher  
 Dusky flycatcher  
 Eastern kingbird  
 Eastern phoebe▲  
 Gray flycatcher◆  
 Great-crested flycatcher▲◆  
 Hammond's flycatcher  
 Least flycatcher▲  
 Olive-sided flycatcher▼  
 Pacific-slope flycatcher  
 Say's phoebe  
 Scissor-tailed flycatcher◆  
 Western kingbird  
 Western wood-pewee▲  
 Willow flycatcher  
 Yellow-bellied flycatcher

## Vireos (Vireonidae)

Blue-headed vireo  
 Cassin's vireo  
 Philadelphia vireo  
 Red-eyed vireo  
 Warbling vireo  
 Yellow-throated vireo◆

## Wrens (Troglodytidae)

House wren  
 Marsh Wren  
 Rock wren  
 Sedge wren▲◆  
 Winter wren

## Wagtails and pipits (Motacillidae)

American pipit  
 Sprague's pipit▲

## Waxwings (Bombycillidae)

Bohemian waxwing  
 Cedar waxwing

## Woodpeckers and allies (Picidae)

Black-backed woodpecker▲  
 Downy woodpecker  
 Hairy woodpecker  
 Lewis's woodpecker▲◆  
 Northern flicker  
 Pileated woodpecker▲  
 Red-breasted sapsucker◆  
 Red-headed woodpecker◆  
 Red-naped sapsucker  
 Three-toed woodpecker  
 Williamson's sapsucker◆  
 Yellow-bellied sapsucker

# APPENDIX 2

## Wood-warblers (Parulidae)

American redstart  
Bay-breasted warbler▲  
Black-and-white warbler  
Black-throated blue warbler  
Black-throated gray warbler◆  
Black-throated green warbler▲  
Blackburnian warbler▲◆  
Blackpoll warbler  
Blue-winged warbler◆  
Canada warbler▲  
Cape may warbler▲  
Chestnut-sided warbler  
Common yellowthroat▲  
Connecticut warbler  
Kentucky warbler◆  
MacGillivray's warbler  
Magnolia warbler  
Mourning warbler  
Nashville warbler  
Northern parula◆  
Northern waterthrush  
Orange-crowned warbler  
Ovenbird  
Palm warbler  
Pine warbler◆  
Tennessee warbler  
Townsend's warbler  
Wilson's warbler  
Yellow warbler  
Yellow-breasted chat  
Yellow-rumped warbler

## MAMMALS

**Total species:** 52

**Total Sensitive/May Be At Risk species:** 10

**Total Exotic species:** 2

- ▲ Indicates Provincial listing as Sensitive
- ▼ Indicates Provincial listing as May Be At Risk
- Indicates Provincial listing as At Risk
- \* Indicates Exotic species

### Bear family (Ursidae)

Black bear

### Beaver family (Castoridae)

Beaver

### Dog family (Canidae)

Coyote  
Gray wolf  
Red fox

### Cat family (Felidae)

Canada lynx▲  
Bobcat▲  
Cougar▲

### Deer family (Cervidae)

Moose  
Mule deer  
Wapiti  
White-tailed deer

### Evening bat family (Vespertilionidae)

Big brown bat  
Hoary bat▲  
Little brown bat  
Long-eared bat▼  
Long-legged bat  
Red bat▲  
Silver-haired bat▲  
Western small-footed bat▲

### Hare family (Leporidae)

Snowshoe hare  
White-tailed jack rabbit

### Jumping mouse family (Dipodidae)

Western jumping mouse



## Mouse family (Muridae)

Deer mouse  
Heather vole  
House mouse\*  
Meadow vole  
Muskrat  
Northern grasshopper mouse  
Prairie vole  
Sagebrush vole  
Southern red-backed vole  
White-footed mouse

## Pocket gopher family (Geomyidae)

Northern pocket gopher

## Porcupine family (Erethizontidae)

Porcupine

## Raccoon family (Procyonidae)

Raccoon

## Shrew family (Soricidae)

Dusky shrew  
Masked shrew  
Prairie shrew

## Skunk family (Mephitidae)

Striped skunk

## Squirrel family (Sciuridae)

Columbian ground squirrel  
Gray squirrel\*  
Least chipmunk  
Northern flying squirrel  
Red squirrel  
Richardson's ground squirrel  
Thirteen-lined ground squirrel

## Weasel family (Mustelidae)

Badger▲  
Ermine  
Least weasel  
Long-tailed weasel▼  
Mink

## FISH OF THE BOW RIVER BASIN

**Total species: 22**

**Total Sensitive species: 1**

**Total Exotic species: 2**

- \* Indicates Exotic species
- ▲ Indicates Provincial listing as Sensitive
- ♥ Indicates introduced sport fish

## Minnows (Cyprinidae)

Emerald shiner  
Flathead minnow  
Longnose dace  
Lake chub  
Pearl dace  
Spottail shiner

## Perches (Percidae)

Yellow perch

## Suckers (Catostomidae)

Longnose sucker  
Mountain sucker  
White sucker

## Sculpins (Cottidae)

Spoonhead sculpin

## Pikes (Esocidae)

Northern pike

## Cods (Gadidae)

Burbot

## Sticklebacks (Gasterosteidae)

Brook stickleback

## Trout-perches (Percopsidae)

Trout-perch

# APPENDIX 2

## Trout and Whitefish (Salmonidae)

Brook trout \* ♥  
Brown trout\* ♥  
Bull trout▲  
Cutthroat trout  
Lake whitefish♥  
Mountain whitefish  
Rainbow trout♥

## REPTILES

**Total species:** 4

**Total Sensitive species:** 4

▲ Indicates Provincial listing as Sensitive

### Species

Painted turtle▲  
Plains garter snake▲  
Red-sided garter snake▲  
Wandering garter snake▲

## AMPHIBIANS

**Total species:** 6

**Total Sensitive/May Be At Risk/At Risk species:** 3

▲ Indicates Provincial listing as Sensitive  
▼ Indicates Provincial listing as May Be At Risk  
■ Indicates Provincial listing as At Risk  
\* Indicates Exotic species

### Species

Boreal chorus frog  
Canadian toad▼  
Leopard frog■  
Tiger salamander  
Western toad▲  
Wood frog

# APPENDIX 2

## VASCULAR PLANTS

**Total species:** 845 (different subspecies have been counted as separate species)

**Total Sensitive/May Be At Risk species:** 53

**Total Exotic species:** 148

PLANT GROUP	FAMILIES REPRESENTED	TOTAL NUMBER OF SPECIES		NUMBER OF SENSITIVE/MAY BE AT RISK SPECIES		NUMBER OF EXOTIC SPECIES	
		PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP
Trees	Aceraceae	5	87	0	5	0	4
	Betulaceae	6		0		0	
	Cupressaceae	2		0		0	
	Elaeagnaceae	2		0		1	
	Fabaceae	1		0		0	
	Fagaceae	2		0		0	
	Hippocastanaceae	2		0		0	
	Juglandaceae	2		0		0	
	Oleaceae	5		1		0	
	Pinaceae	22		1		1	
	Rhamnaceae	1		1		1	
	Rosaceae	18		0		1	
	Salicaceae	14		3		0	
	Tiliaceae	2		0		0	
	Ulmaceae	3		0		0	
Shrubs	Berberidaceae	1	63	0	1	0	2
	Betulaceae	2		0		0	
	Caprifoliaceae	10		0		1	
	Cornaceae	1		0		0	
	Cupressaceae	2		0		0	
	Elaeagnaceae	3		0		0	
	Ericaceae	1		0		0	
	Fabaceae	1		0		0	
	Grossulariaceae	6		0		0	
	Hydrangeaceae	1		1		0	
	Oleaceae	1		0		0	
	Ranunculaceae	3		0		1	
	Rosaceae	14		0		0	
	Salicaceae	16		0		0	
	Solanaceae	1		0		0	

# APPENDIX 2

PLANT GROUP	FAMILIES REPRESENTED	TOTAL NUMBER OF SPECIES		NUMBER OF SENSITIVE/ MAY BE AT RISK SPECIES		NUMBER OF EXOTIC SPECIES	
		PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP
Forbs/Herbs	Alismataceae	2	535	0	36	0	119
	Amaranthaceae	4		0		3	
	Apiaceae	13		3		1	
	Apocynaceae	1		0		0	
	Araliaceae	1		0		0	
	Asteraceae	127		4		28	
	Balsaminaceae	1		0		0	
	Boraginaceae	12		1		4	
	Brassicaceae	45		3		19	
	Callitrichaceae	1		0		0	
	Campanulaceae	2		0		1	
	Cannabaceae	1		0		0	
	Capparaceae	2		1		0	
	Caprifoliaceae	1		0		0	
	Caryophyllaceae	22		0		11	
	Ceratophyllaceae	1		0		0	
	Chenopodiaceae	13		0		5	
	Convolvulaceae	2		0		1	
	Cornaceae	1		0		0	
	Crassulaceae	1		0		0	
	Cuscutaceae	1		1		0	
	Euphorbiaceae	3		0		1	
	Fabaceae	50		2		13	
	Fumariaceae	1		0		0	
	Gentianaceae	5		2		0	
	Geraniaceae	4		0		1	
	Haloragaceae	1		0		0	
	Hippuridaceae	1		0		0	
	Hydrocharitaceae	2		1		0	
	Hydrophyllaceae	1		1		0	
	Iridaceae	3		2		0	
	Juncaginaceae	2		0		0	
	Lamiaceae	14		0		5	
	Lemnaceae	1		0		0	
	Lentibulariaceae	2		0		0	
	Liliaceae	16		1		1	
	Linaceae	4		0		1	
	Lythraceae	1		0		1	
	Malvaceae	3		0		1	
	Nyctaginaceae	1		0		0	



# APPENDIX 2

PLANT GROUP	FAMILIES REPRESENTED	TOTAL NUMBER OF SPECIES		NUMBER OF SENSITIVE/ MAY BE AT RISK SPECIES		NUMBER OF EXOTIC SPECIES	
		PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP
Grasses	Poaceae	99	99	7	7	23	23
Sedges	Cyperaceae	35	35	2	2	0	0
Rushes	Juncaceae	9	9	0	0	0	0
Ferns and fern allies	Dryopteridaceae	1	13	0	0	0	0
	Equisetaceae	9		0			
	Ophioglossaceae	2		0			
	Selaginellaceae	1		0			
Parasitic/ carnivorous	Orchidaceae	3	4	2	2	0	0
	Orobanchaceae	1		0			
Total vascular plants species in Calgary: 845							

# APPENDIX 2

## NON-VASCULAR PLANTS AND LICHENS

**Total species:** 101

**Total Sensitive:** 7

PLANT GROUP	FAMILIES REPRESENTED	TOTAL NUMBER OF SPECIES		NUMBER OF SENSITIVE SPECIES	
		PER FAMILY	PER PLANT GROUP	PER FAMILY	PER PLANT GROUP
<b>Mosses</b>	Amblystegiaceae	10	53	1	6
	Brachytheciaceae	2		0	
	Bryaceae	6		1	
	Dicranaceae	4		0	
	Ditrichaceae	2		0	
	Entodontaceae	1		0	
	Funariaceae	2		1	
	Hylocomiaceae	2		0	
	Hypnaceae	6		2	
	Mniaceae	3		0	
	Orthotrichaceae	2		0	
	Pottiaceae	8		1	
	Rhytidiaceae	1e		0	
	Tetraphidaceae	1		0	
	Thuidiaceae	3		0	
<b>Liverworts</b>	Aneuraceae	1	10	0	0
	Lepidoziaceae	1		0	
	Lophocoleaceae	2		0	
	Marchantiaceae	1		0	
	Pallaviciniaceae	1		0	
	Pelliaceae	1		0	
	Plagiochilaceae	1		0	
	Ptilidiaceae	1		0	
	Scapaniaceae	1		0	
<b>Lichens</b>	Bacidiaceae	1	38	0	1
	Candelariaceae	1		0	
	Cladoniaceae	4		0	
	Collemataceae	1		0	
	Lecanoraceae	1		0	
	Parmeliaceae	10		0	
	Peltigeraceae	4		0	
	Physciaceae	5		0	
	Porpidiaceae	2		0	
	Ramalinaceae	2		1	
	Teloschistaceae	6		0	
	Verrucariaceae	1		0	
<b>Total non-vascular plants species in Calgary: 101</b>					

**Imprint**

LAB Biodiversity Report: The City of Calgary

**Publisher**

The City of Calgary

**Editor**

Julie Sengl

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**Layout and print**

Creative Services, The City of Calgary

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ICLEI Africa Secretariat.

**Printed in Canada**

**Obtainable from**

Electronic copies obtainable upon  
request from:

Local Action for Biodiversity,  
ICLEI Africa  
Secretariat

E-mail: [lab@iclei.org](mailto:lab@iclei.org)

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